ELECTRICAL REVIEW

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VIEWS, NEWS AND INTERVIEWS.

According to recent statistics Germany boasts now of 23 industrial or financial companies in connection with electricity, the capital of each of which amounts to at least 1,500,000 marks, the most important possessing a capital of 47,000,000 marks, while that of six others varies between 24,000,000 marks and 40,000,000 marks, five others range between 10,000,000 marks and 16,000,000 marks, and eight control from 3,000,000 marks to 8,000,000 marks.

Among the last mentioned, the Union, of Berlin, has just decided upon the increase of its capital from 3,000,000 marks to 18,000,000 marks. The share capital of these 23 concerns is 354,000,000 marks, out of which 317,000,000 marks has been paid up. But, with the debenture capital amounting to 102,000,000 marks, and the reserve funds of 36,564,714 marks, it can be stated that a total amount of 493,000,000 marks is invested in the great German electrical enterprises, not taking into consideration the numerous minor companies. The last dividend declared by 20 of these ventures has varied between five per cent (minimum) and 15 per cent (maximum), the average being nine per cent.

Superintendent Murray, of the Bureau of Combustibles, at fire headquarters in New York city recently issued a set of regulations governing the transportation, sale and use of calcium carbide. Mr. Murray said that the stuff was a source of danger to firemen should they be called to fight fire in a building in which it was stored. When water comes in contact with it, acetylene gas is liberated, and should this come in contact with a fireman's lantern or other light an explosion would follow. It was to guard against this that the regulations were framed with the intention of having it kept only at certain places and under certain conditions. In transit through the city and on storage it must be enclosed in hermetically sealed iron receptacles marked "dangerous, if not kept dry." No package may contain more than 100 pounds. It may be kept in bulk in isolated, fireproof and waterproof buildings where there is neither artificial light nor heat. Permits for the sale of calcium carbide will be issued by the Bureau of Combustibles for not more than 20 pounds, in bulk or cartridges. It must be kept in a fireproof safe or vault above the street grade and must be elevated at least six inches above the floor.

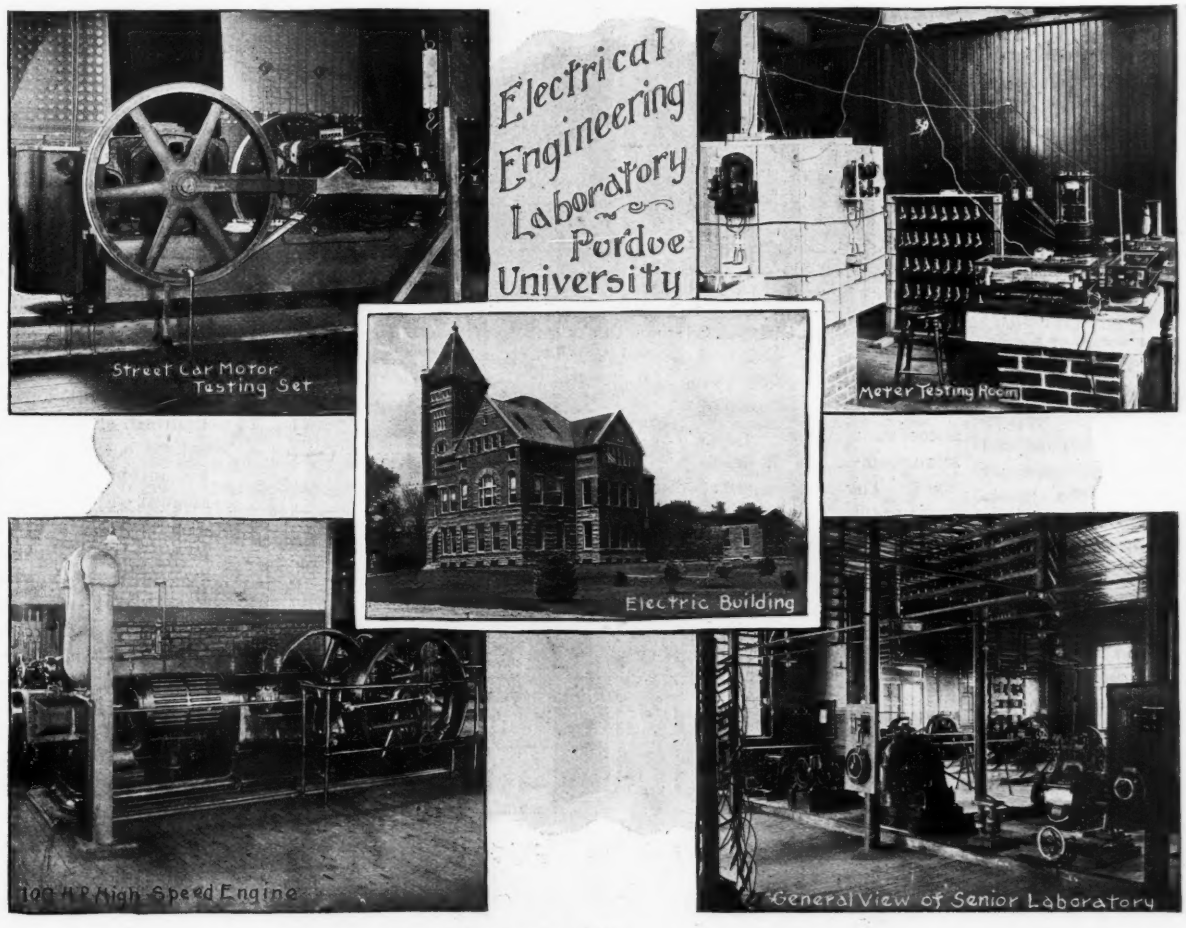
Electrical Engineering Laboratory Purdue University
Street Car Motor Testing Set
Meter Testing Room
Electric Building
100 H.P. High Speed Engine
General View of Senior Laboratory

FIG. 1.—ELECTRICAL ENGINEERING AT PURDUE UNIVERSITY.

The Bloomfield & Orchard Lake, Mich., Electric Railroad Company, with a capital stock of $50,000, has been incorporated with the Secretary of State. George L. Hendrie is the principal stockholder.

Electrical Engineering at Purdue University.

The school of electrical engineering at Purdue University, Lafayette, Ind., was established in September, 1888, and the first regular graduate took his degree in 1891. There are now 144 alumni of the school distributed over the country, chiefly in the middle West. Among these are five professors in engineering in American universities; seven instructors and numbers of others engaged in electrical manufacturing, central station work, street railways, telephony and electrical newspaper work; 100 in all are engaged in electrical pursuits. The average income of the members of the class of '92 is $1,500 per year, grading down to $460 a year as the average income of the class of '98; nine per cent of the alumni are making over $1,800 per year each.

The school of electrical engineering is under the direct charge of Prof. Winder Elwell Goldsborough, who is professor of electrical engineering and director of the electrical laboratory. Associated with him are Professors Duff, Matthews and Taylor, with several instructors and assistants. As will be observed from the accompanying illustrations, the school of engineering is well equipped with

practical laboratory facilities for carrying out its functions.

The basis of the electrical engineering course at Purdue is naturally one which involves a knowledge of the fundamental principles of physics. The course in physics is designed to familiarize the student with the physical principles that underlie all engineering and to fit him to readily grasp the many applications of these principles which he will encounter constantly in his professional career. The physical laboratory course in electricity and magnetism is postponed until the junior year.

The student enters the dynamo laboratory at the beginning of his senior year and continues his work there during the remainder of his course. It is here that familiarity with apparatus in commercial and industrial form is acquired. The dynamo laboratory is equipped with a general switchboard which controls the entire current supply. A complete and generalized system of wiring is gradually being installed throughout the building. The switchboard makes it possible for a student to connect any one piece of apparatus with another piece or series of pieces. Voltmeters, ammeters and wattmeters are stored on shelves around the laboratory when not in use for experimental work. The dynamos and motors are mounted on solid masonry piers; nearly all are of the direct-current type.

One of the pieces of apparatus is a Gramme machine imported from France during the Centennial in 1876, and is therefore highly prized for its historical interest, and at the same time it is a valuable machine for experimental purposes. The other equipment comprises a Thomson-Houston arc-light dynamo, two General Electric street-car motors, with a controller and all necessary connections; a Slattery alternator, a General Electric monocyclic alternator, and a Jenney 500-volt direct-current generator.

The large switchboard is of marble, and was designed especially for the laboratory. The central panel of the board contains two indicating voltmeters, two indicating ammeters and two indicating wattmeters, all of the Thomson type. The department also possesses an unusually large collection of transformers mounted on a specially designed rack. There are over 30 transformers available for laboratory testing, one of 300 lights capacity, eight of 100 lights capacity and the others smaller. A number of transformer tests have been carried on in the electrical laboratory during the past two years. The most important tests at present in progress are the ageing tests of a number of different makes of modern transformers.

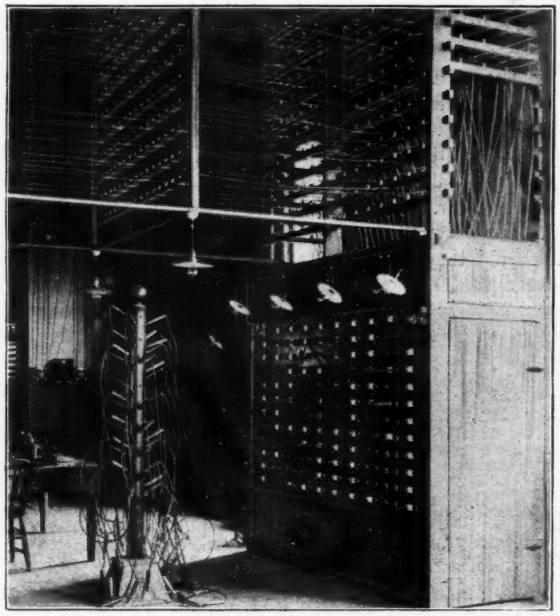

FIG. 2.—THE GENERAL SWITCHBOARD IN THE ELECTRICAL LABORATORY AT PURDUE UNIVERSITY.

In a separate room, mounted on masonry piers, are two Kelvin balances used in calibrating. In the same room is the photometric equipment. The department at different times has done a considerable amount of work in standardizing lamps for manufacturers.

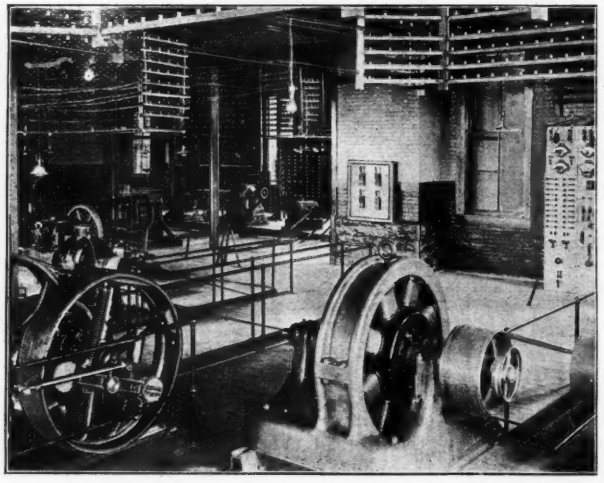

FIG. 3.—THE DYNAMO LABORATORY AT PURDUE UNIVERSITY.

ELECTRIC RAILWAY NOTES.

At a recent meeting of the stockholders of the Highland, Ky., Railway Company the following directors were elected for the ensuing year: Jacob Zinsmeister, John Everbach, Charles Schwartzel, Henry Terstegge and John H. Streader.

The Denver, Colo., City Cable Railway has been sold at auction by order of the United States Court, under foreclosure of a mortgage for $4,000,000. The West End Electric was also sold under foreclosure, being purchased by the same company for $40,000.

The Hamilton & Eaton, Ohio, Street Railway Company, with a capital stock of $10,000, has been incorporated; incorporators, J. H. Shallenbarger, James A. Walker, J. E. Anderson, C. F. Elliott and J. C. Unzicker.

A committee of the Board of Trade, of Mount Vernon, N. Y., is investigating the grant of a franchise for an electric road to the New York, Westchester & Connecticut Traction Company, and it is reported that charges will be made against certain city officials in connection therewith.

At the annual meeting of the Staten Island, N. Y., Midland Electric Railroad Company it was decided to reduce the number of directors from nine to seven, and the following named were elected: Robert Wetherill, Richard Wetherill, A. G. Paine, M. M. Armstrong, H. T. Walter, M. J. Wightman and W. B. Rockwell. Richard Wetherill was elected president and general manager to succeed W. B. Rockwell, who recently resigned.

A corporation has been formed in Ansonia, Ct., to be known as the Seymour Electric Railway Company, which will petition the next session of the general assembly for the privilege of building and operating a trolley road between this city and Seymour. Arrangements have been made by which the new company will have the right of way over part of the road of the Derby Street Railway Company, whose power and storage facilities it will also use. The incorporators are prominent business men of Seymour and Ansonia.

At a general meeting of the stockholders of the Ferro Carril Urbano Railroad, of Havana, the sale of the entire stock, amounting to $1,000,000, was authorized at 92. One-half of the amount will be taken by Mr. Geo. W. Young, president of the United States Mortgage and Trust Company; Senator Smith, of New Jersey; Percival Farquhar, F. S. Pearson, Col. G. B. M. Harvey and Hanson Brothers, of Montreal. The other half was taken by Ruffe & Sons and T. W. Todd, bankers, of London. Captain-General Castellanos has issued an order stopping work on the railroad concessions, without prejudice to the rights of any of the parties interested, until the Americans take control.

A Successful Battery Company.

The business of the Gordon Battery Company is rapidly increasing, and friends of the company will be pleased to hear that they will declare immediately a semi-annual dividend of four per cent on the preferred stock from the net earnings of the six months ending January 1, 1899.

The Gordon cells are fast being introduced into the telephone field and fire-alarm service of the country. It is stated that a majority of the railroads have adopted the Gordon cell for operation of signals, and thousands are daily in use.

Telephone News .....and Comment

The Farmers and Merchants' Telephone Company, of Warsaw, Ohio, has been incorporated; capital stock, $5,000.

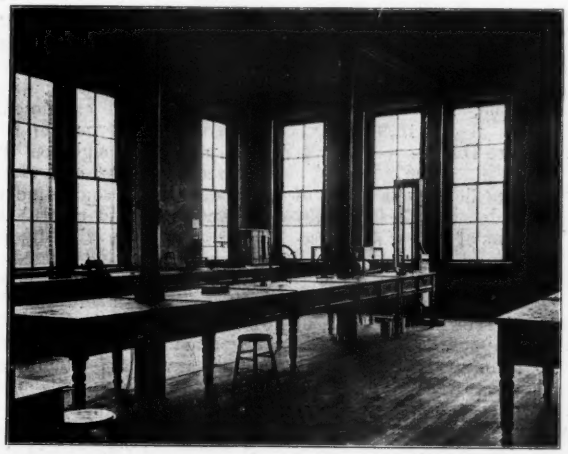

FIG. 4.—THE JUNIOR ELECTRICAL LABORATORY AT PURDUE UNIVERSITY.

The Duluth, Minn., Telephone Company has completed its line to Cloquet.

The Ticonderoga, N. Y., Telephone Company have commenced remodeling their plant.

The United Telegraph, Telephone and Electric Company, Chicago, certified to an increase in the number of its directors from five to nine.

The Lexington, Tenn., Telephone Company has been incorporated by J. E. Meleal, H. E. Gruper, and others; capital stock, $200,000.

The Pennsylvania Telegraph and Telephone Company, of Beaver Falls, has been incorporated by H. C. Patterson and others; capital stock, $50,000.

It has been decided to build a telephone line between Charlotte and Lansing, connecting Potterville and Milletts, which will be completed within 30 days.

The Youngblood-Stampers Telephone Company, Boston, Mass., has been incorporated by R. A. Youngblood, F. H. Stampers and N. H. Youngblood; capital stock, $12,000.

The Thompson & Moab Telephone Company, of Salt Lake City, Utah, has been incorporated by Arthur A. Taylor, president; J. C. Taylor, vice-president; Robert James Thompson, treasurer, and Charles Wilson, secretary, to build and operate a telephone line between Thompson and Moab, Utah; capital stock, $1,400.

F. G. McConnell, who has been manager of the Central Union Telephone Company's exchange at Youngstown, Ohio, since last Spring, has tendered his resignation to the company, to take effect January 1.

FIG. 5.—ONE OF THE PIER ROOMS, PURDUE UNIVERSITY.

The movement to establish telephone communication between Baltimore, Md., and intermediate points and Drum Point has been revived. It is proposed to form a corporation, to be known as the Baltimore, Annapolis and Drum Point Telephone Company, with a capitalization of $12,500.

The Houston & Texas Central Railway has just completed an independent telephone system in Houston, Tex., and it is now in successful operation between the general offices, yards and buildings of the company. The enterprise is a great convenience to all the departments of the road, and is pronounced a success in every respect.

At a meeting of the Catoctin & Myersville, Md., Electric Railway Company in Myersville, the following directors were elected: Cyrus F. Flook, D. C. Winebrener, George William Smith, Joseph W. Gaver, William M. Bittle, John C. Leatherman, George Dallas Gaver, Charles Johnson, George T. Thoms, John T. Hildebrand.

The Postal Telegraph Company has incorporated in Iowa, and announces its intention of expending a large sum in the improvement of its system in that state. General offices for Iowa will be established in Des Moines, and two trunk lines will be built across the state, one from Dubuque to Kansas City, and the other from Sioux Falls via Sioux City, Des Moines and Keokuk to St. Louis. Branches will be built from these, which will give the company connections with practically every town of any importance in Iowa. The business will be centralized at Des Moines, and sent East and West over direct wires.

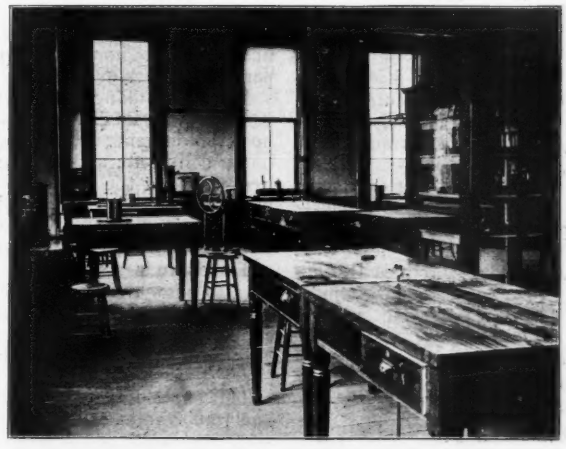

FIG. 6.—THE PHYSICAL LABORATORY AT PURDUE UNIVERSITY.

A deal has been consummated whereby the independent or county telephone companies of Mercer, Lawrence, Butler, Erie, Crawford and Beaver, in Pennsylvania, and Trumbull County, in Ohio, will be connected. The work of connecting up the lines will be commenced at once. The Independent company, of Erie, Pa., is the prime mover.

The directors of the American Bell Telephone Company have declared a regular quarterly dividend of three per cent and one and one-half per cent extra, payable January 16 to stock of record December 31. Books will be closed from January 2 to January 14, both days inclusive. The extra dividend is the regular semi-annual extra dividend and makes 15 per cent for the calendar and fiscal years.

BOOK REVIEW.

"PRISMATIC AND DIFFRACTION SPECTRA." Memoirs of Joseph Von Fraunhofer. Translated and edited by J. S. Ames, Ph.D., Professor of Physics in Johns Hopkins University. Harper & Brothers, New York.

The second of "Harper's Scientific Memoirs" is in keeping with the first. Newton first observed the sun's spectrum in 1666 in a crude fashion. Wollaston, in 1802, went a little further, but it was the good work of Fraunhofer which, beginning in 1814, gave us the fascinating science of spectroscopy. To the student and science reader this little work is doubly welcome, placing as it does in plain English the original papers of Fraunhofer and Wollaston before them. It, with its predecessor of the Memoirs, should have a place in every library.

LONG-DISTANCE TRANSMISSION OF ELECTRIC POWER.

BY PROF. GEORGE FORBES, F. R. S., M. INST. C. E., BEFORE THE SOCIETY OF ARTS, LONDON, NOVEMBER 23.

(Concluded from page 397.)

You will believe then that I possess a mass of tables and curves, and these might be worth publishing if the time had arrived, which is not, perhaps, yet. During these years, however, my methods have gradually become so simplified that I venture to bring to your notice one curve in relation to the one special question of efficiency and cost of transmission lines. It is so simple in its present form through a gradual evolution that I can not help thinking that it may be of use to others.

In transmission schemes the cost of copper becomes so all-important, when dealing with long distances, that it helps more than I can tell you to have simple means for estimating even roughly the cost and efficiency under various conditions.

I feel some difficulties in laying before you these methods, because there is nothing new in the results, and all results can be obtained by the ordinary methods. They have, however, been invaluable to myself. These methods are particularly useful for getting out preliminary estimates so quickly.

Here let me say that in all preliminary work on the cost of long conductor lines, I never take notice of the resistance of the conductor, nor of the value of the current. I deal only with the current density and loss of volts. It is the same thing under a different name. But it is what you want.

Again, I never use, in calculation for my own use, the efficiency of the conductor system. It is far more convenient to use the inefficiency, or the reciprocal of the efficiency, which is also the horse-power put into the generating end of the line to deliver one horse-power at the other end.

I give you these suggestions for what they may be worth as the result of long experience.

I suppose every one present is aware of the fact that if you had a case where the power cost absolutely nothing, you would use the least copper and have the cheapest arrangement, with an inefficiency of two; i. e., an efficiency of 50 per cent, or two horse-power generated for each horse-power delivered. If you make the current density either greater or less than what is required to produce this inefficiency, then you have to use more copper to deliver the same quantity of power.

This is a point which in a general way is appreciated by the business man who is not an electrician, as has been already stated.

Fig. 1 shows this very well, and a study of it is interesting. We see that the copper required to transmit one horse-power 100 miles, at an initial pressure of 10,000 volts, with continuous current, falls with the increase of density until the efficiency is 50 per cent, and then rises. This figure shows the weight of copper required per horse-power delivered at a distance of 100 miles at 10,000 volts. It is drawn for the simplest case of continuous current, to which corrections only for temperature and sag have to be made. It is equally applicable to a single-phase or a two-phase alternating transmission to 100 miles at 10,000 effective volts; or at

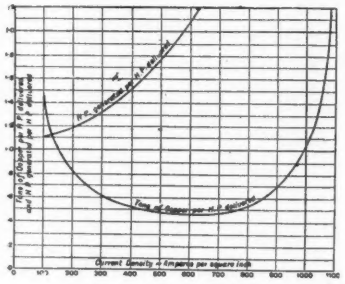

FIG. 1.—TRANSMISSION CURVE FOR 100 MILES AT 10,000 VOLTS CONTINUOUS CURRENT.

5,000 effective volts from any wire to the middle of the electric system, or to three-phase transmission to 100 miles at 5,000 effective volts from any wire to the middle of the electric system. But, with alternating current, corrections must be made for self-induction and capacity.

The same remarks apply to the meaning of the voltage of the line in all the curves and tables referred to. They are worked out for continuous current, and for any other system the engineer must add the usual corrections.

Another curve may be drawn showing the inefficiency at each current density. This curve constantly rises; i. e., the greater the current density, the greater is the inefficiency.

Now, from these two curves we can deduce a third curve, which is the one which I find gives one in a few minutes all the main facts one wants for any horse-power to be delivered to any distance at any initial volts.

This curve gives the tons of copper per horse-power delivered at 100 miles with 10,000 volts, continuous current, in terms of the horse-power generated per horse-power delivered.

Measuring along a horizontal line you get the inefficiency; i. e., the horse-power generated for each horse-power delivered; and measuring vertically you get the corresponding tons of copper required for each horse-power delivered at a distance of 100 miles.

The curve is also marked with figures to show the current density, in amperes per square inch section of copper.

I never travel a day without this curve in my pocket.

This curve is correct for 100 miles and 10,000 volts, or for any other case where the volts equal 100 times the miles. The curve shows you, for example, that for an inefficiency of one and one-half you require a current density of 387 amperes per square inch and .55 tons of copper. And thus current density and weight of copper per horse-power is the same, whether you use 10,000 volts at 100 miles or 100 volts at one mile.

For any other volts and distance in miles, V and M, you divide the volts by the miles and get $\frac{V}{M}$; then $\frac{V}{100M}=D$, the multiplier for the current density, and $\left(\frac{V}{100M}\right)^2=T$ the divisor, for the tons of copper per horse-power.

As an example, 15,000 volts and 300 miles. Here $D=\frac{15{,}000}{100\times 300}=\frac{1}{2}$. Hence, for an inefficiency as above of $1\frac{1}{2}$, the current density will be $\frac{1}{2}\times 387=198$. The tons of copper per horse-power will be $\frac{.55}{(\frac{1}{2})^2}=2.20$ tons.

Now let me show another use of the curve. Suppose we capitalize the cost of running the generating station, and add to it the cost of the generating works, and divide by the horse-power, we have then the capitalized value of one horse-power generated; I will call it for short the value of one horse-power generated. We also know the cost of one ton of copper. Divide the value of the horse-power by the value of the ton of copper, and draw a line across the axes so that it cuts the axes in that ratio. Draw a line parallel to this and touching the curve. This gives you, according to Lord Kelvin's law (as modified by Ayrton and Perry), the point of maxi-

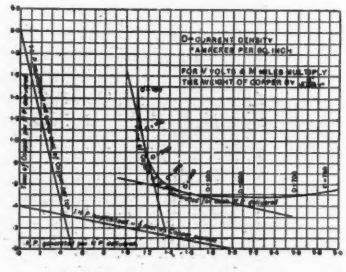

FIG. 2.—TRANSMISSION CURVE FOR 100 MILES AT 10,000 VOLTS CONTINUOUS CURRENT.

mum economy giving directly the inefficiency, the tons of copper per horse-power and the current density. Thus on the curve two examples are shown, one where the value of one-horse-power is four times that of a ton of copper. In this case the greatest economy is got by an inefficiency of 1.18, a current density of 180 amperes per square inch, and 0.91 tons of copper per horse-power delivered at 100 miles distance, the initial pressure being 10,000 volts.

Another example is shown on the curve where the horse-power is one-fifth of the cost of a ton of copper. The resulting values are seen directly to be: Inefficiency=1.58; current density=420; copper=0.51 tons.

To do this for other values of T $\left(T=\left(\frac{100M}{V}\right)^2\right)$ you must divide the value of the horse-power by T. Measure this distance vertically by the unit on the vertical scale or by fractions of these units, and measure the cost of a ton of copper horizontally by the unit on the horizontal scale or by the same fraction as before of that unit. Join the two points by a line and draw a parallel line touching the curve at the point of maximum economy.

You will see now how valuable such a curve must be for obtaining the very information that an engineer requires in his first examination of any project. But we can do more than this. Divide the tons of copper per horse-power by eighteen times the distance in miles, and you get the sectional area in square inches of the conductors (go and return) per horse-power. Multiply this by the total horse power to be delivered, and you get the size of your conductors.

N. B.—Remember that this is all worked out for continuous current, and must be corrected for other systems as well as for temperature and sag.

Some people prefer to work by tables instead of by curves, so I will put down the readings of the curve which we have just been discussing. For ordinary work the following is sufficient:

Inefficiency.	Tons Copper per horse-power.	Current Density.
1.20	.86	190
1 30	.66	266
1.40	.58	330
1.50	.55	387
1.60	.51	432
1.70	.49	475
1.80	.48	510
1.90	.472	545
2.00	.470	574

In most practical cases, however, the economical inefficiency for long-distance transmission lies between 1.20 and 150. The following table gives closer values over this range:

Inefficiency.	Tons.	Density.
1.20	0.86	190
1.22	0.80	207
1.24	0.76	221
1.26	0.72	236
1.28	0.69	250
1.30	0.66	266
1.32	0.64	279
1.34	0.62	292
1.36	0.60	306
1.38	0.59	319
1.40	0.58	330
1.42	0.57	342
1.44	0.56	354
1.46	0.55	365
1.48	0.54	376
1.50	0.53	387

From either of these tables, having given the inefficiency, to get the density for any volts and distance, multiply the above value by $\frac{V}{100M}$, and to get the tons of copper, divide the above value by $\left(\frac{V}{100M}\right)^2$.

This little table enables us, then, with a very simple piece of arithmetic, to get the result for any case that may arise sufficiently close.

But in actual practice I find it far more useful to have the table extended in such a way that an approximate

result may be arrived at without any calculation.

Three tables are here given. The first gives a reference letter for any volts and distance. In the second and third tables the results we want are found under that reference letter. The second table gives the tons of copper per horse-power delivered, and the third gives the current density for any inefficiency that we may select.

RULES FOR USING THE TABLES.

Rule I. To Find the Reference Letter—In Table I, in the column referring to the volts generated, find the approximate distance of transmission in miles. The capital letter at the beginning of the line in which this is found is the reference letter.

Rule II. To Find the Tons of Copper per Horse-Power Delivered—Look along the row in Table II, referring to the reference number, and tons of copper are there given for each inefficiency; the inefficiency being the horse-power generated to deliver the horse-power at the distant point.

Rule III. To Find the Current Density—Table III gives this in amperes per square inch in the row corresponding to the reference number, and in the column corresponding to the inefficiency chosen.

Rule IV. To Find the Economical Conditions of Working (Kelvin's Law)—Divide the capitalized value of one horse-power by the cost of one ton of copper. Divide this by 10 and call it q. In Table II look along the row corresponding to the reference letter until the difference between successive numbers is approximately q. The number at the head of that column is the economical inefficiency, the tons are also then given, and the current density is obtained directly in Table III.

Rule V. To Find the Total Section (go and return) of all the Transmission Conductors—Multiply the tons per horse-power by the total horse-power, and divide by 18 times the distance in miles. This is the result in square inches. Dividing this by the number of conductors gives the sectional area of each.

I trust that I have not wearied you with these arithmetical conundrums. All that I can say is that I have found them of the greatest use, and I shall be very pleased if some of you do so also.

I trust that all here present who are not engineers realize now that the cost of transmission of electric power to a distance is a pure question of balancing expenditure and profits. By the methods now described, or by the ordinary methods, there can be no question as to the cost of the work. The only point, in fact, affecting the cost which has been left to the choice of the engineer is the electric pressure to be used, and every engineer in reporting on a scheme generally gives his reasons for selecting the pressure. In old days the highest pressure for which we could get a guarantee from contractors was used. But the expense of insulation increased so much with increase of pressure that now, as at Rheinfelden, we work to that pressure which is the most economical. Manufacturers will now guarantee any pressure if you will pay for it.

Having now determined with sufficient accuracy the cost of the works and their maintenance, annual expenses and interests on mortgage, the next thing is to see—or perhaps this ought to be the first matter attended to—what return can be obtained for the power delivered to a distance. It is, then, for the purely financial men to say whether the profits to be derived are worth the venture.

TABLE I—DISTANCE OF VOLTS.

Virtual Volts Between Wires.

	5,000	10,000	15,000	20,000	25,000	30,000
1 or 2 phase..	4,325	8,650	12,975	17,300	21,625	25,950
3 phase.....						

DISTANCES IN MILES.

A	12.5	25	37.5	50	65.5	75
B	25	50	75	100	125	150
C	37.5	75	112.5	150	187.5	225
D	50	100	150	200	250	300
E	62.5	125	187.5	250	312	375
F	75	150	225	300	375	450
G	87.5	175	262.5	350	437.5	525
H	100	200	300	400	500	600
K	150	300	450	600	750	900

TABLE II—TONS OF COPPER PER HORSE-POWER DELIVERED.

Inefficiency.	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
A	.0587	.0412	.0362	.0344	.0319	.0306	.0300	.0295	.0294
B	.2150	.1659	.1450	.1375	.1275	.1225	.1200	.1180	.1175
C	.4837	.3725	.3262	.3094	.2869	.2756	.2700	.2655	.2644
D	.8600	.6600	.5800	.5500	.5100	.4900	.4800	.4720	.4700
E	1.344	1.031	.9062	.8594	.7969	.7656	.7500	.7375	.7344
F	1.935	1.499	1.305	1.237	1.148	1.102	1.080	1.062	1.058
G	2.634	2.020	1.776	1.684	1.562	1.504	1.470	1.446	1.439
H	3.440	2.640	2.320	2.200	2.040	1.960	1.920	1.888	1.880
K	7.740	5.940	5.220	4.950	4.590	4.410	4.320	4.248	4.230

TABLE III—CURRENT DENSITY.

Amperes per square inch.

Inefficiency.	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
A	760	904	1,320	1,448	1,728	1,900	2,040	2,180	2,236
B	380	452	660	724	864	950	1,020	1,090	1,148
C	253	301	440	515	576	633	680	727	765
D	190	226	330	387	432	475	510	545	574
E	152	181	264	310	346	380	408	437	459
F	127	151	220	258	288	317	340	363	383
G	108	129	188	221	246	271	292	311	327
H	95	113	165	193	216	237	255	272	287
K	63	75	110	129	144	158	170	182	191

It has been my object to-night to put before engineers some useful rapid methods for arriving, on the ordinary lines of working, at the data for any special case of long-distance transmission of power. It has also been my object to show that those who carry out such schemes do not require to be handicapped by the enormous capital which has hitherto been generally considered necessary. Incidentally, it would appear that whenever gold mines exist which can afford to pay 5s. or 6s. per ton of ore milled, and if there be good water-power within 400 miles of the mines, it is most probable that it will pay well to transmit the power electrically.

If I have convinced any doubters that simply in my limited experience I have found many cases where it will pay well to transmit power to distances of several hundred miles, then my purpose is served, and I shall be glad that I have brought this subject to your notice.

ELECTRIC LIGHT FLASHES.

The Swedesboro Light, Heat and Power Company, Woolwich Township, N. J., has been incorporated by Charles D. Lippincort and others, to manufacture electricity for light, heat and power; capital, $20,000.

The electric light plant and the car lines of the Akron, Ohio, Street Railway and Illuminating Company will be sold to the highest bidder within the next six weeks. A reorganized company, of which Gen. Sam Thomas, of New York, is at the head, will bid in the line when it is sold.

The W. E. Douley Electric Light and Power Company, of Big Rapids, Mich., has been incorporated to supply electricity for light, heat and power; authorized capital, $40,000; incorporators, W. E. Douley, J. S. Douley, D. M. Martindale, Chicago, Ill.; J. W. Morton, W. I. Trott, Big Rapids, Mich.

The Tuolumne County Water and Electric Power Company, of Columbia, Cal., has been incorporated to furnish water, electric power and light; authorized capital, $550,000; incorporators, J. W. Ellis, William Mansfield, Thomas Conlin, J. B. Pownall, Columbia; M. B. Harriman, Shaws Flat; George Wight, Springfield; George W. Hale, Sonora.

At the annual meeting of the stockholders of the Edison Electric Light Company, of York, Pa., the following directors were elected: Geoffrey P. Yost, A. F. Geesey, C. A. Eisenhart, Edwin T. Moul, W. F. Bay Stewart, B. S. Gilbert and Harry S. Wiest. The directors afterwards organized by electing Geoffrey P. Yost, president; C. A. Eisenhart, vice-president; A. F. Geesey, secretary, and C. C. Frick, treasurer.

The Central Trust Company will be ready December 28 to issue temporary certificates calling for six per cent 99-year gold bonds of the Kings County Electric Light and Power Company. At the time these certificates are issued the Edison stockholders' committee will pay to Brooklyn Edison stockholders of record of September 30 last a dividend of two per cent out of the moneys received from the Brooklyn Edison Company for that purpose. The exact amount of the final dividend can not be known until all outstanding claims against the Edison company as of June 30, 1898, have been liquidated. As soon as such claims have been settled a further and final dividend will be made.

Beginning January 1 electric light will usurp the time-honored prerogatives of oil, wax and gas at the Vatican at Rome, says a newspaper correspondent. The suites of apartments containing the accumulations of art treasure and the archeological collections, which, owing to a deficiency of light, have not hitherto been exposed to public view, hereafter will be brilliantly illuminated. The Pope himself seized the initiative. As a rule his holiness rarely superintends economic arrangements of any kind, while any suggestion of alterations in the household invariably meets with his disapproval. Leo XIII looks upon the Vatican as his prison and the gardens as his paradise. Large sums are expended on the beautifying of the latter, for in the gardens alone he feels perfectly at home, and rarely leaves them at nightfall without a sigh. The Pope glories in light and revels in color, and it is not surprising that the electric installation engrosses his interest. St. Peter's is also to be lighted by electricity.

Our New Chicago Representative.

[*From Electrical Engineering.*]

Mr. Frank E. Colbert has been appointed western representative of the ELECTRICAL REVIEW, with headquarters in the Old Colony Building, Chicago. Mr. Colbert for some time past has been connected with the electrical department of the Miller-Knoblock Company, and previous to that time spent several years East, engaged in the electrical and street railway supply business. Mr. Colbert is a young man of much energy and high integrity. His general acquaintance among the electrical trade, and the fact of representing such a high-class publication, will make it an easy matter for him to obtain a large share of the business. *Electrical Engineering* extends its best wishes for his success.

Electrical Review

[OLDEST ELECTRICAL WEEKLY IN THE UNITED STATES.]

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NEW YORK, DECEMBER 28, 1898.

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SPECIAL NOTICE TO ADVERTISERS.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue. NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

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An amazingly progressive sign of the times is the great number and variety of electrical toys and useful electrical apparatus now to be had for the amusement and instruction of children. It seems that even in the realm of holiday presents the steam locomotive has been supplanted by the trolley car.

THE RESULT OF TWIN SUGGESTIONS.

In the ELECTRICAL REVIEW of November 23, 1898, appeared the following editorial note:

If those archaic Fifth avenue stages, with their travesty horses, which are an eyesore to New York city, were replaced with handsome electric omnibuses, wouldn't it be fine! The route traveled by the stages is over asphalt pavements, an ideal roadway for electric vehicles. The street-car horse will soon disappear from metropolitan thoroughfares, and the Fifth avenue stage horse will be the last ghost of equine rapid transit. May his days be few and briefly numbered in the land which he afflicts!

The announcement was made last week that, in line with our suggestion, the archaic stages are to be removed and a line of electrical carriages installed.

In the same journal, same date, appeared another editorial note, as follows:

The city of Brooklyn is just now greatly agitated over a trolley car with side doors, adopted by the Nassau line on its very extensive system. When first introduced these cars met with favor, as they are open on one side, and the several doors of the cross aisles proved a convenience for the crush of people to get on at Park row, New York. With the coming of cold weather, however, the cars prove to be very unsatisfactory, on account of draughts, inability to land passengers on crossings, and general clumsiness in construction. Mass meetings have been held and resolutions adopted condemning them. It is evident that the cars are a mistake for Winter service, and President Johnson, who is an able street-railway man, will no doubt see that a change is probably made.

Last week President Johnson put all this type of cars in his Winter barn and replaced them with the former ones. Quite a pair of coincidences.

The explosion of the new gas tank in New York city deprived a large part of the lower city of gas for one night and one day. Those who had the electric light did not suffer except where the gas flame was needed. This particularly applied to the daily press using type setting machinery, and several of the dailies had to go back to hand composition temporarily. The gas company, with most commendable enterprise in the face of an appalling accident, were able to remedy the trouble in time for a supply of gas the second night.

The banking business possesses many attractions. The Garfield National Bank, of this city, announces a quarterly dividend of 10 per cent. President Gelshenen is entitled to a Christmas remembrance from his stockholders.

It seems that electricity can not supplant gas where a flame of heat is required.

The telephone is the business man's best friend in these days of holiday shopping.

This is a great season for the enclosed arc-lamp industry. Numerous refinements and improvements of detail have been introduced and the lamp has been adapted to a number of new uses.

Some one now suggests that when the rapid-transit tunnel is constructed the city should stock it with feeder lines and go into the business of furnishing electric light and power. The "municipal ownership" cranks still flourish.

The ELECTRICAL REVIEW estimates that at least $50,000,000 worth of apparatus for electric railways and central electric lighting stations will be sold within the boundaries of Greater New York within the next four years.

The great scarcity of water the past year along the gold belt in California has doubtless nipped in the bud several schemes for power transmission. No such scheme is reliable without a certainty of large and continuous supply of water.

Everybody get ready for an extraordinary business year in 1899. The signs are right for a record-breaker, especially in the electrical field. The man who has good goods, ample manufacturing facilities, capital enough, bright and intelligent salesmen and plenty of good advertising is the man who is going to be busy.

Jernegan, he of sea-water gold-brick notoriety, now safely abroad and suffering from nostalgia, wants to come home, and is said to have offered his dupes here $75,000 if they will keep their hands off and "call it square." Monumental assurance is no longer an apt phrase for such qualities in a man.

Speaking of sea water and Jernegan, why didn't he and his company go after the sodium instead of the gold? The production of caustic soda from sea water would seem to be quite feasible, and such a scheme would have none of the disreputable glamor of gold bricks. And it would have had the merit of stretching out the period of tithe-taking on the part of the inventor and archschemer.

We commend to our readers the striking remarks of Prof. George Forbes in his paper on "Long-Distance Transmission of Electric Power" before the Society of Arts, London. The paper was begun in our last issue and is concluded this week, and bristles with information of the greatest interest, coming, as it does, from so eminent an authority.

WALL STREET AND THE ELECTRICAL STOCK MARKET.

In spite of the holidays and the fact that the New York Stock Exchange was closed to-day, the week was unusually active in financial circles and the current month promises to be a record-breaker in the commercial history of the country, so far as the volume of transactions is concerned. Our export trade is constantly increasing, and has reached wonderful proportions.

At the close of business of the New York exchange on Friday of this week General Electric was 93¾ bid and 94 asked. Edison Electric Illuminating Company of New York, closed at 191 bid and 192 asked. Western Union closed at 92¾ bid and 92⅞ asked. On the Boston exchange American Bell Telephone closed at 275 asked with no bid price. Erie Telephone closed at 77 bid with no asked price. On the Philadelphia exchange Electric Storage Battery, common, closed at 57⅛ bid and 57¾ asked.

Wall Street, December 24.

CHANCE FOR A CIVIL SERVICE APPOINTMENT.

The United States Civil Service Commission announces that it is desired to establish an eligible register from which a selection may be made to fill an existing vacancy in the grade of assistant engineer, electrically qualified, at a salary of $1,000 per annum, in the custodian service at Baltimore, Md. Eligibility for appointment will be determined from an examination into each applicant's experience, ability and character as a workman, and physical qualifications for the work to be performed.

Fifth Avenue Stages in New York to be Replaced by Automobiles.

It was announced last week that the Fifth Avenue Stage Company, of New York city, had been purchased by Messrs. Albert J. Elias, Henry Hart and Edward Lauterbach, of the Third Avenue Railroad Company, of New York. It was also stated that the line hereafter would be operated in harmony with the Third Avenue Railroad Company's lines and that transfers would be issued mutually. Mr. Lauterbach was quoted as saying:

"It is a fact that the Fifth Avenue Stage Company has been sold. Its service will be improved. The substitution of new motive power is being considered, and what the new power will be will be decided within a week. It is likely to be either electricity or compressed air. If electricity, the surplus from the new electrical plant of the Third avenue railroad might be utilized.

"Transfers from the Fifth avenue stage line to all the lines of the Third avenue railroad system can be arranged by means of the Forty-second street, Manhattanville & Amsterdam avenue line, which crosses Fifth avenue at Forty-second street. The Fifth avenue stage line at present runs from Eighty-eighth street south to Bleecker street, but it has the right of extension down South Fifth avenue to Canal street and along Canal street to the North River, enabling the company's vehicles to reach the Desbrosses street ferry."

The ELECTRICAL REVIEW is authoritatively informed that the chances favor the adoption of electric vehicles as the new method of service.

Chicago Electrical Association.

At the regular meeting of the Chicago Electrical Association on December 16, Mr. Arthur Vaughn Abbott, chief engineer of the Chicago Telephone Company, delivered a lecture on "Wireless Telegraphy." His practical demonstrations, with working apparatus, were enthusiastically received by the large audience. Mr. Abbott has been experimenting and developing his apparatus during the past year, and has now established communication between his office and residence, two miles distant. In the lecture the principles underlying wireless telegraphy were fully explained, with due credit given Hertz and other pioneers, and later investigators.

After the lecture the annual election of officers was held with the following result: President, Thomas G. Grier; vice-president, J. M. Hollister; treasurer, Harold Almert; secretary, Cloyd Marshall, and directors, F. S. Hickok, E. W. Jewell and Hayward Cochrane.

PERSONAL.

Mr. George E. Hatch, of the Hatch Storage Battery Company, Boston, was a visitor to New York city last week.

Mr. Nikola Tesla, who has been ill with the grip, is much improved in health and again devoting long hours to laboratory work.

Mr. Cyrus O. Baker, Jr., president of the Electrical Exposition Company, states that the outlook is very favorable for the exhibition next May.

Mr. Thos. A. Edison intends devoting the Winter to laboratory work at Llewellyn Park. His great iron m nes will be started up with full force as soon as the weather next Spring permits.

Mr. R. L. Daus, the architect, has been appointed by Mayor Van Wyck a member of the commission to codify the building laws of the city of New York. Mr. Daus is the only architect on the commission, and his appointment is a most admirable one in all respects.

Chief Engineer Gardiner C. Sims, of the United States repair ship "Vulcan," has been detached from his vessel and ordered to his home by the Navy Department. The many friends of Mr. Sims in electrical and mechanical engineering circles will be glad to have him with them again.

Mr. A. C. White, the eminent telephonist, of Providence, R. I., remembered several of his New York friends with the great American bird, the turkey, for which Rhode Island is justly famous. The special delivery of this welcome token was made at midnight at the different households, so there could be no doubt of the man of the house being there to receive it.

Prof. Sidney H. Short sailed for Europe on the "Majestic" on December 13. Professor Short resigned from the management of the Walker Company at the time of the sale of that concern to the Westinghouse company, and will now take the first real vacation he has had in several years. He contemplates an extended trip through England and the Continent and will visit Liverpool, Leeds, Manchester, London, Paris, Frankfort and Berlin. Though Professor Short goes for a complete rest, he has already been invited to address several scientific societies and will probably read several papers on electric railroading in America. Professor Short has been identified with the development of electric traction from its earliest days. What is perhaps not so well known is that Professor Short is a physicist and chemist of some note, having filled the chair in these branches of science for some years in the University of Denver. Professor Short expects to return to this country in the Spring of 1899.

FOREIGN ELECTRICAL NEWS.

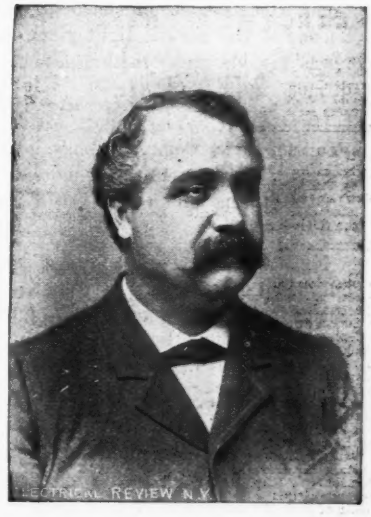
A New Electric Insulator—A problem which has yet to be solved, and which inventors have been endeavoring for many years to solve, is the substitution of another material in place of gutta-percha as an insulator. The latest formula, which has just been patented in Germany, is as follows: Certain materials, such as ozokerite, amber and asphalt, are heated in a retort, and at a temperature of 400 degrees. This sets at liberty the volatile gases, and the residue is employed in the manufacture of the insulator. The residue is of a blackish color and has the consistency of wax or dry rosin. It is claimed by the inventor that it can be used in covering cables, being employed either alone or mixed with gutta-percha, mineral powders or sulphur. The substance is said to have sufficient plasticity not to crack or break when the cable is bent or twisted. The best proportion to be observed in the manufacture of the article is 50 parts of ozokerite, 45 of yellow amber and five of asphalt.

The Bullier Patents Annulled in Germany—The *Moniteur des Industries Electriques* publishes a report that the *Patent-amt* of Berlin has annulled the Bullier patent. This patent was granted in 1874 to a French chemist as being the only process having a practical interest in the production of carbide of calcium by electro-thermic means. Until recently this patent, which, in Germany, is owned by the Aluminum Company of Neuhausen, was an obstacle in the development of lighting by means of acetylene in Germany; the annulling of the patent will result in an appreciable reduction in the cost of carbide of calcium. This invention was carried out in precisely the same manner by an American named Willson, who, in 1884, obtained patents protecting it in America and England. The patents, however, were based on very feeble rights, the priority for the manufacture of the article being strictly due to Professor Borchers, of Germany, who failed, however, to make any use of his knowledge in a practical manner.

Death of R. T. McDonald.

Ronald T. McDonald, president of the Fort Wayne Electric Corporation, of Fort Wayne, Ind., died suddenly at Dallas, Tex., on December 24. He was a man of great energy and business ability, and had extensive interests in many enterprises. He was the largest individual stockholder in the Hoffman House, New York city, the Fort Wayne Electric Corporation, the Fort Wayne Lamp Manufacturing Company, of Cleveland, Ohio, an artificial ice plant in New Orleans, and a paper mill in Ironton, Ind., besides having other smaller investments. He was in Dallas on business when his death occurred.

Mr. McDonald was born in Pittsburgh, Pa., about 45 years ago. He was for a time engaged in the dry-goods business, and later went into electric lighting. He lived in Fort Wayne, where he owned a large stock farm, upon which he bred blooded horses and cattle.



THE LATE R. T. MCDONALD.

He leaves a widow and a daughter fifteen years old. The funeral will take place in Fort Wayne. It is believed that he left a large estate.

In Good Time for '99.

TO THE EDITOR OF ELECTRICAL REVIEW:

I send, as usual, the sum of money to cover one year's subscription to the ELECTRICAL REVIEW.

I always like to send it in good time before your rush of orders comes in. Respectfully,

E. D. SHRINER.

December 17.

A deal involving the construction of an electric line from Louisville, Ky., to Jeffersonville, across the Big Four bridge, is said to be in contemplation.

OUR CANADIAN LETTER.

LAKE MEGANTIC, QUE.—The Electric Light Company has purchased the property on which to erect its power-house.

BRAMPTON, ONT.—The agreement between the Hutton Electric Light Company and the Corporation has been signed by the Mayor.

PEMBROKE, ONT.—The report of R. J. Parke, of Toronto, on the cost of installing an electric light plant will be presented in a few days.

FORT WILLIAM, ONT.—The appointment of superintendent of the electric light plant has been given to Mr. W. H. Smith, of Goderich.

MITCHELL, ONT.—The by-law to raise $5,000 by debentures for improving the electric light plant was defeated by the ratepayers last week.

THOROLD, ONT.—The Electric Light Committee have recommended the extension of the electric light plant as far as possible under the present conditions.

HULL, QUE.—The report of the Electric Light Committee has been referred back by council for more detailed information on the cost of installing a plant.

NELSON, B. C.—The judge has quashed the by-law which authorized the council to borrow money to purchase the electric light plant from a private company.

SHERBROOKE, QUE.—The North Hately Electric Company has purchased a water power on the Magog River, and proposes furnishing light and power to this city.

ACTON, ONT.—The by-law to provide $6,000 for the purchase of an electric light plant has received sanction by the ratepayers. Arrangements will be made for the installation of the plant immediately.

HALIFAX, N. S.—A special committee has been obtaining information as to the advisability of the city undertaking its own street lighting, and as a result the city electrician and engineer have received instructions to prepare plans and invite tenders for a plant.

OTTAWA, ONT.—L. K. Jones, secretary Department of Railways and Canals, invites tenders up to December 28 for the construction of a power-house, and the installation of electrical apparatus for the lock bridges and other structures, and lighting the Soulanges Canal.

PRESCOTT, ONT.—The consulting engineer, Mr. John Galt, of Toronto, is preparing plans and designing a system of waterworks, sewerage and electric lighting for this town. Commissioners will be appointed at the forthcoming January elections, and work will proceed during the year 1899. J. A. C.

Montreal, December 21.

A Portable Testing Set.

The accompanying illustration shows the Jagabi portable testing set for resistance measurements. This instrument has now been on the market for several months and is giving great satisfaction to those who use it. The manufacturers, Willyoung & Company, of Philadelphia, claim that the Jagabi set is more compact and convenient to operate than other instruments of its class. The theoretical range of measurement possible with the Jagabi portable testing set is from .001 ohm to more than 11 megohms. The outfit comprises a D'Arsonval galvanometer of latest design, set of resistance coils with total capacity of 11,110 ohms, reversible arm Wheatstone bridge with ratio of 1 to 1,000, keys for galvanometer and battery, and six chloride of silver dry cells. All these parts are mounted in a handsomely finished mahogany case, with lock and handle. The total weight is seven pounds, so that the instrument can be carried from place to place very readily. James G. Biddle, 910 Drexel Building, Philadelphia, is sole selling agent for the Jagabi portable testing set, and describes it fully in his new catalogue B, "Electrical Measuring Instruments," recently issued. This catalogue contains 108 pages of valuable data concerning testing instruments, and should be in the hands of every one interested in the subject. Mr. Biddle states that he will mail a copy to any address upon receipt of 10 cents in stamps.

A PORTABLE TESTING SET.

Annual Dinner of the British Institution of Electrical Engineers.

The annual dinner of the British Institution of Electrical Engineers was held at the Hotel Cecil, London, on December 11. A large number of prominent guests were present.

Sir R. Webster proposed a toast to "The Institution of Electrical Engineers," remarking that it was the embodiment of the most extraordinary development of science that this great Victorian era had ever seen. It was the fact that practical electricity, the history of the practical application of electricity, was exactly contemporaneous with the reign of the Queen. When they thought what the development of electric telegraphy had been, this reign had seen in that branch of electrical science marvelous and extraordinary developments. The institution was the embodiment of the fact that electrical science, enterprise and engineering were, perhaps, the most powerful factors in modern scientific work. He wished the institution every success, feeling sure that it would shed its influence over all parts of the world.

The president, Mr. J. W. Swan, replying to the toast, said that during its 27 years of existence the institution had adapted itself to the wants of the times, steadily keeping its place in the march of progress, and, he thought, in the van. It had twice changed its name and modified its rules, in deference to the changes, developments and diversities of operation in electrical engineering that had arisen. During the past 27 years electrical undertakings due to British enterprise alone had absorbed a capital verging on £100,000,000. If they extended their view from their own country, and took account of what had been done and was being done in all parts of the world, they saw that the miles of electric railway and tramway were to be counted by thousands, the horse-power transformed into electric power by hundreds of thousands, the miles of telegraph and telephone lines by millions, and the incandescent lamps by tens of millions. What greater development the future had in store for them was hard to guess. Whether the new form of telegraphy without wires would grow up an important branch of electrical engineering, or whether in the early years of the twentieth century any very large proportion of the industries of the world would be carried on by means of power, electrically and aerially transmitted from great waterfalls, time alone could answer. At all events, the field of operation of the electrical engineer would be vastly extended, and the duties and responsibilities of members of the Institution of Electrical Engineers would be greatly increased in the future. One of the signs of the progress of the institution was that their revenue was increasing, and that their membership now numbered 3,000.

Mr. W. H. Preece, in responding to the toast "Science," said the greatest civilizer in this world in the present day was the engineer. They had obliterated from the English language the word "impossible," and they could absolutely prophesy that next year they would learn the unexpected.

Northwestern Electrical Association.

The seventh annual convention of the Northwestern Electrical Association will be held at Hotel Pfister, Milwaukee, Wis., commencing on Wednesday, January 18. The following papers will be read and discussed: "Trend of Central Station Design," by B. J. Arnold, Chicago; "Meter-Rate Systems," by E. L. Debell, Sheboygan, Wis.; "Design of Secondary Circuits in Alternating Plants," by George L. Thayer, Belle Plaine, Iowa; "Electricity Direct from Coal," by Prof. A. J. Rogers, Milwaukee; "Inductive Loads on Alternating-Current Transformers," by Prof. D. C. Jackson, Wisconsin University; "Electric Vehicles and Their Relation to Central Stations," by H. M. Maxim, Hartford, Ct.; "Association Management," by H. L. Doherty, Madison, Wis. The association will, at this meeting, inaugurate the "Question Box" on a new plan designed to remedy the defects of that institution as usually conducted.

Electrical Machinery in Mines.

A great increase in the amount of electrical machinery used in the mines of the West is a boon to be hoped for and, the writer believes, to be realized.

There are several reasons why the mining industry has not kept pace in an electrical way with other enterprises. The fault is partly with the manufacturers of electrical supplies and partly on account of the lack of electrical knowledge on the part of mine operators or superintendents.

The mining industry is destined to become one of the most profitable fields for electrical machinery in the country.

In the first place, a number of appliances, though excellent for ordinary above-ground work, are inadequate for the underground necessities of a mine. Take the telephone as an example. A glance at the advertising pages of this or any other first-class electrical journal will show that there are a multiplicity of grades and styles of "phones," but all of them are adapted to above-ground work. Possibly the manufacturer does not appreciate the quality of telephone needed in a mine. It should be, first, reasonable in price and single in construction. All moving parts as springs, etc., should be strong and securely put together. Excepting the brass work, every metal part should be tinned or galvanized, including the screws, springs, lock, key, etc. Every electrical contact must be soldered. It is very important that all inside wires be insulated and the induction coil made water and damp-proof. These precautions are necessary, because in most mines the 'phones on the mine end will be drenched with water all the time, or at least be in a permanently damp place. It must be made so as to be easily and quickly taken down and put up in an advance position as the tunnel or drift progresses. Of course, a telephone not made as above specified will work only for a limited time. I have seen an "expert" try again and again to make a mine 'phone work, with only the result that it would work for a week or less and then cease to respond. True, the mine superintendent can order a telephone or any other piece of apparatus to order, but he is not likely to do so, because he is usually not capable, and if he were, like most others, waits till his attention is called to a certain improvement by an article or advertisement in some publication. I speak from experience as well as observation. Most people require urging before making improvements, so before we can expect the mines to be supplied with improved appliances some one must construct such articles in an especial manner, so that they will appeal to the mining man as being exactly suited to his purpose. Next, these articles must be brought to his notice, and, third, he must be taught how to use these improvements. The two latter subjects will be discussed later.

There is no doubt that the number of mines using electric lights could be trebled in a short time by following the proper course. The mine manager can usually be convinced, efficiency being considered, that incandescent lights under ground are more economical than candles, especially where abundant free water-power is near at hand.

The ideas that an "expert" electrician is required to attend to a small

FIG. 1.—ARC LAMP WITH REFLECTOR.

isolated electrical plant at a mine must be abandoned. The mine superintendent or foreman must be educated to the extent of being able to care for the small plant. Mine owners will search for and engage superintendents who can direct the care of electrical machinery, when they are convinced that a saving can be effected thereby. The steam engineer or mill foreman can be assigned the task of oiling, cleaning and caring for the dynamo, etc., if the superintendent's time is occupied with other duties. In small mines the superintendent can care for the electrical machinery himself. A little manual labor will do him good. One of the chief hindrances to the installation of small electrical plants has been the supposed necessity of engaging an exclusive electrician. Of course, a large plant for either light or power would require an able electrician.

There are many small appliances about a mine that can be operated advantageously by electricity; e. g., ventilating fans. These are usually exhaust fans and are operated at high speed so that they could be operated by a direct-connected motor. The smith forge used for sharpening drills, picks, etc., can also be operated by an electric blower. Though such fans and blowers are on the market, the makers seem to be afraid the miner will find it out.

The subjects of electric pumps and hauling engines are endless. Suffice it to say that so far the cost of such machines, all things being considered, is prohibitive at present. There is a strong demand and a large field for an efficient electrical pump. To be a success it must be able to compete with compressed air and steam pumps, be light as possible and have few wearing parts. There is a difficulty encountered in designing such a pump, as the speed of a pump working under great water pressure must be slow, and the force or pressure per square inch exerted must be very high.

Now as to bringing these improvements to the attention of the buyer. The writer's opinion is that this can best be done by inducing more prospective buyers to read electrical journals, and this in turn can be accomplished by these journals publishing more descriptive matter regarding electrical mining machinery and appliances. Permit me to say in this connection that many electrical journals follow either one extreme or another; namely, they refrain from describing individual machinery on the ground that it gives the seller a free advertisement and may also cause jealousy among the patrons of their advertising columns; or they print glowing descriptions of unmeritorious machinery for which they are indirectly paid. The latter class of work is by the smaller journals.

As to teaching the mine superintendents the value and use of the various electrical appliances, this also can be accomplished by increasing the circulation of electrical journals in the mining districts, and this increased circulation can be gained by filling the reading columns with information for the would-be electrician as well as for the expert.

It should be self-evident that the best advertising medium is that which not only informs the seller of prospective buyers, but that which also informs (by advertisements and descriptive matter) the purchaser of what to buy; that is, the best advertising medium circulates among both buyers and sellers.

The above is written in a spirit of suggestion rather than criticism, with the hope that the miner, the manufacturer and the electrical journals will work more in the direction indicated to increase the use of electrical machinery in the mines, thus bringing about a mutual benefit to the trio and the public in general.

O. H. PACKER,
Mgr. Mining Dept. Heald's College.
San Francisco, December 20.

FIG. 2.—ORNAMENTAL ARC-LAMP SUSPENSION.

Ornamental Arc-Lamp Suspension and Reflector.

Ornamental suspension brackets frequently furnish a very desirable method of hanging arc lamps. The General Electric Company's wrought-iron bracket, shown in the illustration herewith, has been designed for use with short lamps, such as the General Electric carbon-feed, direct and alternating-current lamps. It is made up of two lengths of wrought-iron, held at right angles to each other by a malleable iron T casting. At the outer end of the horizontal arm a hard-wood cross-arm, with porcelain insulators, furnishes a support for the wires, and the lamp is hung from a suspension hook directly beneath. The angle formed by the pieces of pipe is filled with scroll-work of wrought-iron, which is ornamental and which gives the structure the necessary rigidity. The standard bracket is 24 inches high and the distance from the center of the lamp to the wall is 30 inches. Similar brackets of any desired dimensions can, of course, be furnished.

While the enclosed-arc lamp gives a greater diffusion of the light than the open arc lamp, additional downward projection of the light may be obtained by the use of a reflector, and as the enclosed lamp may be installed nearer the ground than can the open arc, no sacrifice of intensity to secure diffusion is necessary.

The reflector illustrated is also made by the General Electric Company. It is of galvanized iron, having its inner side lined with white porcelain, furnishing a very efficient reflecting surface. The shape is unlike that of the reflector used with the older types of lamps. It adds to the appearance of the lamp, and by reflecting the useful rays downward it saves much of the light that would otherwise be lost. It also serves as a protection to the lamp when additional precautions against weather are necessary. This reflector is especially adapted for use with alternating enclosed-arc lamps.

HIGH-VOLTAGE POWER TRANSMISSION.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, OMAHA, JUNE 30, 1898, BY CHAS. F. SCOTT.

(*Continued from page 393.*)

High-Tension Tests at East Pittsburgh—Laboratory tests and measurements on a small scale can not take the place of tests under the conditions of practical service, such as those at Telluride. There are, however, many important elements which may be determined by laboratory measurements.

A high-tension line for testing insulators and making measurements upon the losses between wires was erected at the East Pittsburgh factory in the Fall of 1897. A number of the tests which have been made are here recorded.

1. A test was made to determine whether the wave form of the charging current to the line was similar to that through a resistance, or whether it was modified by the loss component, the loss occurring only at the higher part of the electro-motive-force wave. The current to the high-voltage line, at pressures varying from 30,000 to 60,000 volts, was passed through a coil possessing high self-induction. The electro-motive force upon the coil was measured by a voltmeter. The electro-motive force was also measured when a current of equal strength was passed through the coil, the line being short-circuited and a low electro-motive force applied. It was found that the voltage upon the coil was the same, within a small error of observation, in both cases, showing practically no difference in the wave form of the current under the two conditions. The current was from an armature giving practically a sine wave.

2. The charging current to the line was measured under several different conditions when the current was obtained from a generator giving practically a sine wave. The results of measurements were compared with the currents as calculated by the theoretical formula. The last measurement in the table was made upon the Niagara–Buffalo line, with current from a Niagara generator, which differs slightly from a sine wave.

A table giving the calculated charging current for a number of conditions will be found in Appendix B.

3. The fall of potential around the wires was noted by tests made with spark-gaps. The wires, 48 inches apart, were connected to the high voltage terminals and a spark-gap was placed between two idle wires, also 48 inches apart, placed about 21 inches below the first wires. A spark-gap consisting of brass terminals, with a one-fourth-inch radius, was placed between the two idle wires. When the gap was one-thirty second inch the sparking began, when the electro-motive force from the raising transformer was 26,000 volts. A gap of one-thirty-second inch requires an electro-motive force of 2,200 volts to produce sparking. When the spark-gap was made eight-thirty-seconds inch (equivalent to 12,000 volts) the sparking began at 103,000 volts from the raising transformer. At intermediate points there is a fair proportionality between the spark-gap and the electro-motive force.

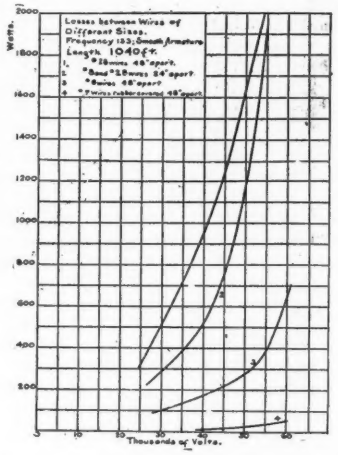


FIG. 13.—HIGH-VOLTAGE POWER TRANSMISSION.

In another test a spark-gap was placed between one of the idle wires and the adjacent wire of the live circuit. When the spark-gap was one-eighth inch (equivalent to 6,000 volts) the spark passed when the electro-motive force was 17,500 volts, and when the spark was made one-fourth inch (equivalent to 12,000 volts) the sparking began at 33,000 volts. When the gap was three-eighths inch (equivalent to 16,000 volts) sparking began at 41,000 volts. When the gap was one-half inch (equivalent to 20,000 volts) sparking occurred at 49,000 volts. The electro-motive force did not differ greatly from a sine wave.

COMPARISON OF MEASURED AND CALCULATED CHARGING CURRENT TO PARALLEL WIRES. LENGTH, ONE MILE—10,000 VOLTS.

Size of Wire.	Distance between Wires.	Frequency.	Measured Current.	Calculated Current.
No. 8 B and S	21.7"	60	.0307 Amperes	.028 Amperes
8 B and S	48.0"	60	.0245 "	.0252 "
8 B and S	79.5"	60	.0234 "	.0238 "
8 B and S	127.5"	60	.0225 "	.0222 "
No. 8 and ground	120.0"	60	.0427 "	.0412 "
0.71" diameter	18" for 2/3 of distance 36" " 2/3 " "	25	.0176 "	.0176 "

4. The effect of the size of wire upon the loss was investigated by running a pair of No. 28 brass wires 0.0126 inch in diameter and then replacing it by large rubber-covered wires. The rubber covered wire was No. 7 Brown & Sharpe gage, 0.144 inch in diameter; the outside diameter of the rubber covering was 0.3 inch and the diameter over the braid was 0.35 inch. In each case measurements were made upon another circuit which was unchanged during the different tests, and thus served for comparison. The results of these tests are shown in Fig. 13, which also gives the conditions when one fine wire and one wire of larger size, No. 8 Brown & Sharpe, constituted the circuit. This comparison shows the very marked increase in loss when the fine wire is used. The loss is greatly decreased when the rubber-covered wire is used. The loss on the rubber covered wire, however, increased considerably after the voltage had been raised and the rubber had broken down, thus permitting the current to pass freely to the outer surface of the insulation. It is quite probable that the loss would increase as the insulation became defective, until it was nearly equal to that of a wire having the same total diameter.

The measurements on wires of different size, given in Fig. 13, are qualitatively correct, although some of the readings on which the curves are based were quite small, so that the absolute values may not be exact.

5. The effect of the current in drying the surface of the insulators was illustrated in a test made during a rain. Upon applying 45,000 volts to a circuit, the wattmeter indicated 116. After four minutes the deflection had decreased to 72, the current remaining the same. The electro-motive force was then increased to 60,000 volts, the wattmeter deflection increased to 155, and at the end of three minutes it had fallen to 138. The current was one-third greater than at the lower voltage, but remained constant while the wattmeter changed. The rain continued during the test, which shows, therefore, that the condition of the insulator is materially improved by the presence of the current.

(*To be continued.*)

NEWS OF THE TRADE.

The "Kinsman" desk electric lamps and portable lamps are offered by McLeod, Ward & Company, Thames Building, New York.

The K. & W. Company, Pittsfield, Mass., during the month just ending, report having received three times as many orders for "Hardy" incandescent lamps as in any month of their previous existence.

I. P. Frink, maker of reflectors and reflecting chandeliers, 551 Pearl street, New York, informs the ELECTRICAL REVIEW that he will be glad to send his new Frink catalogue, "Book of Light," to inquirers.

The Eureka Electric Company, Chicago, makers of telephone apparatus, are now offering the "Eureka" telephone switchboard, about which they say: "It is the most rapid switching apparatus ever offered to the independent field," adding that the striking features of the apparatus are contained in the following points: Self-restoring drop, self-restoring ring-off and a rapid connecting device.

The Washington Carbon Company, Pittsburgh, Pa., manufacturers of the "Helios" carbons, now have branch offices at New York, 751 Bowling Green Building and 529 Tremont Building, Boston. The Pittsburgh factory is producing large quantities of the "Helios" carbons for all electrical purposes, especially of solid carbons for series arc lighting cored carbons for alternating lighting, and cored and solid carbons for direct current. In addition to these standard forms of the "Helios" carbon the Washington Carbon Company make self-lubricating motor brushes, battery cups and plates and special designs in carbon.

The Montauk Multiphase Cable Company, New York, have certainly gained an unusual and rapid success with the thermostatic wires and cables now so well known to electricians and architects under that name. In a recent interview given an ELECTRICAL REVIEW representative one of the gentlemen of the company showed interesting evidence of wide adoption of the product, not only in America but throughout the entire world. Within the past year it has been indorsed by many municipal organizations and such companies as the Gamewell Auxiliary Fire-Alarm Company, who are now using it in their equipments. As has been explained, the cable is thermostatic in every infinitesimal part, and is alive to any dangerous heat or flame, giving automatic indication of disturbances of this nature at any desired point. It is so constructed that it may be used in place of plain wire for all interior adaptations, such as bells, telephones or district service. The cables are standardized in sizes, and are similar in appearance to other products, being small, flexible and perfectly insulated. The company, at their offices, 100 Broadway, have practical demonstrations of the applications of these cables and are glad to make exhibitions to visitors.

The Pacific Electric Company, La Crosse, Wis., are advertising the new designs of the "Espersen adjustable shade" lamp. They say that this lamp, by concentrating the rays, increases the light 50 per cent, and is adaptable to any desk, table or piano where incandescent circuits are used. The Pacific Electric Company have recently issued a handsomely illustrated catalogue, which they will mail upon application.

The "Reliable" Telephone Apparatus.

In view of the many lines of telephone apparatus now being manufactured, it is our aim to illustrate and describe the important variations, developments and improvements in telephone construction. Within a comparatively short time the Reliable Electric Manufacturing Company, of Worcester, Mass., have designed a series of instruments which are quite original, several types of which are shown herewith. The illustration, Fig. 1, shows the transmitter which has been perfected in this company's shops. Its construction will be readily seen by a careful study of the picture. It is composed of two carbon plates, one of the carbon plates being adjustably mounted in the transmitter casing and the carbon contact plate being fastened on a thin metal plate and riveted on the diaphragm, leaving a clearance of one-sixteenth of an inch between the carbon plate and the diaphragm, in order to make the whole surface of the diaphragm sensitive to vibrations. The casing is preferably mounted in a suitable socket, so that it can be turned round from time to time, in order to prevent the carbon grains from packing together. An annular felt washer is mounted upon the carbon plate so as to confine a body of powdered or granulated carbon between the carbon plates.

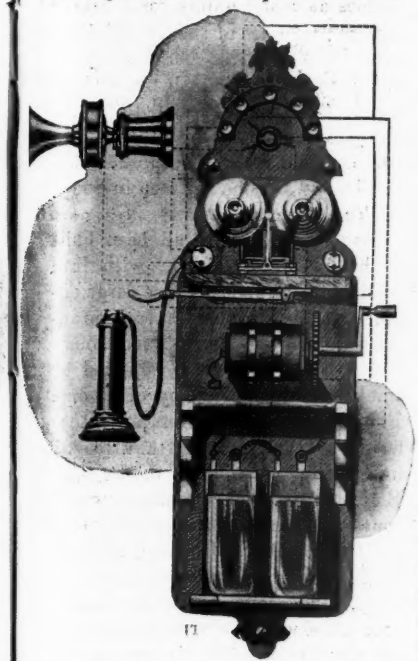


FIG. 2. — MECHANICAL CONSTRUCTION OF "RELIABLE" EXCHANGE TELEPHONE.

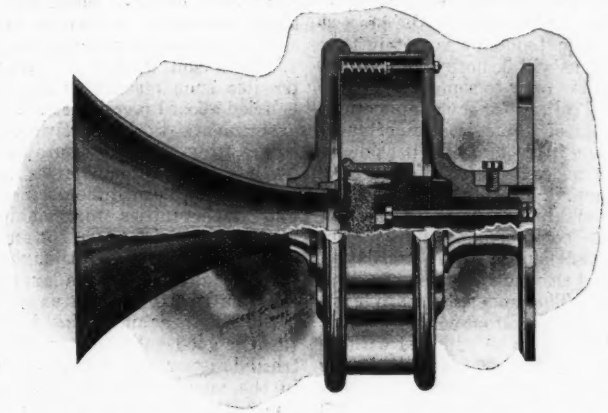


FIG. 1.—THE "RELIABLE" TELEPHONE TRANSMITTER.

At the outer end, the annular felt washer engages a chamfered or inclined edge on the carbon plate, this construction being especially adapted to give a half-sliding, half-compressing motion of the felt washer in order to reduce the friction to the minimun. By providing the carbon contact plates with a serrated or roughened face, an increased area of contact is secured between the carbon grains and the contact plates, so that the vibration of one of the plates will cause a considerable variation in the resistance to the electric current; also, on account of this construction, there will be less liability of the powdered carbon caking or hardening.

In the several other varieties of telephones shown herewith the same form of transmitter is adopted. The illustration, Fig. 2, shows the mechanical construction of the instrument designed by this company for exchange and long-distance service.

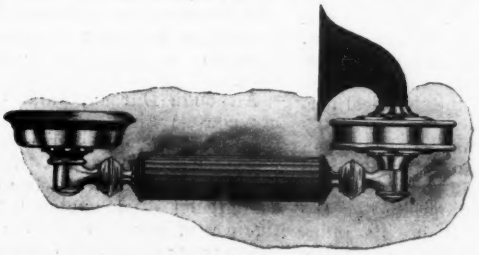


FIG. 4.—"RELIABLE" COMBINATION TRANSMITTER AND RECEIVER.

Fig. 3 shows the same instrument in its assembled condition. It will be observed that it is rather unlike many of the standard market telephones for exchange instruments. The aim of the designer in perfecting this character of telephone apparatus has been to reach a higher degree of perfection in mechanical construction than has heretofore been obtained.

The illustration, Fig. 4, shows the combination transmitter and receiver which is being made for use either with the apparatus manufactured by this company or to be applied to instruments of other make. The illustration, Fig. 5, shows the desk or movable instrument. This is a well finished piece of apparatus, made in polished nickel and carefully constructed as to mechanical and electrical features.

OBITUARY.

Dr. Wellington Adams, inventor and projector of the Chicago & St. Louis Electric Railway, died on December 19 of pneumonia at his home in St. Louis. He was 50 years old, and leaves a widow and six children. Dr. Adams asserted that he was the inventor of the electric motor application of electric power direct to the axle, and squandered a fortune in endeavoring to establish his rights to this patent, but failed of recognition in the courts.

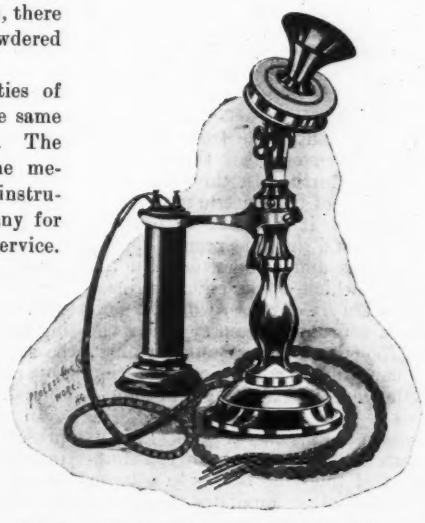


FIG 5.—"RELIABLE" DESK TELEPHONE SET.

Radiography and the Physiology of the Heart.

M. Bouchard, at a recent meeting of the Academy of Sciences, reported some observations he had made upon the thoracic organs by means of the X rays, says the London *Lancet*. Among other things he has been enabled to assert the existence of a marked dilatation of the auricles when the intra-thoracic blood pressure is raised during inspiration. This condition is artificially brought about by endeavoring to inspire with the glottis shut, and is naturally brought about by the violent inspirations during a a paroxysm of whooping-cough. M. Bouchard has also discovered that a clear horizontal space exists during forced inspiration between the shadow of the heart and that of the diaphragm, but during normal inspiration there is no space visible. This phenomenon, which is remarkable, considering that the diaphragm and the pericardium are attached to one another, is explained by M. Bouchard in the following way. During the forced descent of the diaphragm in a large inspiration the inferior surface of the heart is in contact with the diaphragm to a very limited extent. The pericardium tucks itself into the space existing between itself and the heart, forming in front and behind a gutter into which in turn the pulmonary tissue is packed, thus forming a layer of tissue much more penetrable by the X rays than those which make up the heart and the diaphragm.

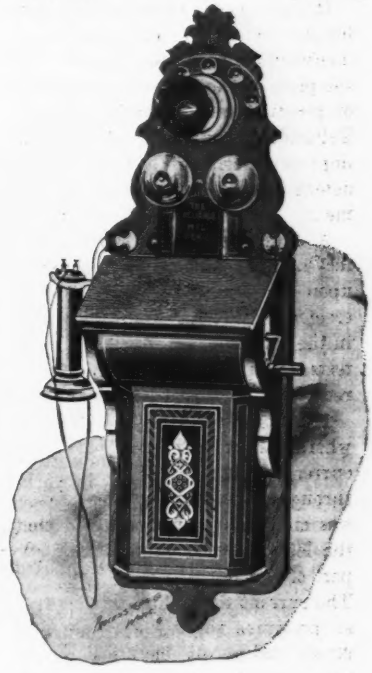


FIG. 3 —"RELIABLE" EXCHANGE TELEPHONE ASSEMBLED.

ELECTRICAL AND ENGINEERING WORK IN THE NAVY DURING THE WAR.

READ BEFORE THE NEW YORK ELECTRICAL SOCIETY, DECEMBER 14, 1898, BY W. D. WEAVER.

The lessons taught by the late war, with respect to the employment of electricity aboard men-of-war, are few in number, though important in their bearing. The most decisive result was the demonstration of the immense superiority of electricity over steam for the operation of turret-training apparatus—a demonstration so decisive, in fact, that the question of the employment of electric power for this purpose is no longer an open one. The society is to be congratulated that one of its members is the inventor of the system whose application has led to this happy result. I refer to Mr. H. Ward Leonard.

Another question which the test of battle has settled definitely is the superiority of electric ammunition hoists, not only in efficiency in working, but in convenience with respect to location and space occupied that will tend to greatly extend the application of electric power on shipboard generally.

Against the great success in the particulars just mentioned must be set the failure of electrical range-finding apparatus, and of electrical indicating apparatus in general. As to the first mentioned, the enemy gave so few opportunities for its use, and even then so little necessity existed for its employment in view of the leisurely manner in which our vessels could pick up their range, that possibly neglect had something to do in the case.

At any rate, electrical range-finding should not be condemned in general because of the failure of a single system. In fact the weak points in the one in question would seem to be easily overcome by the employment of alternating currents of high frequency and considerable voltage, thereby enabling a drop between indicating points to be obtained by means of inductance which would be in the order of volts instead of possibly millivolts, as where the direct current is used. I will add that an apparatus somewhat answering this description has been proposed by Messrs. Crehore & Squier.

As to other indicating apparatus, it should be borne in mind that electrical apparatus of this nature requires a certain amount of expert care which it is not always possible to obtain aboard ship, while the contrary is the case with the mechanical apparatus that it would displace. If in anticipation of battle the latter is thoroughly overhauled, as would be the case, there is more assurance of its efficient working than electrical apparatus under the adverse condition named, notwithstanding the inherent superiority of the latter. This brings up the question of the deficiency aboard ship of necessary electrical skill, which has been made the subject of an official report by the bureau officer in charge of electrical engineering, and will be referred to later on.

The favorable experience with electric power in the important cases just mentioned should accelerate the extension of its application aboard ship, and while, unfortunately, the present bureaucratic tendency is not in that direction, as will be noted later, I shall nevertheless refer to some other cases distinctly calling for such application.

The one of immediate importance, and which in fact can be considered a crying necessity, is that of electric ventilation.

For warship ventilation, both with respect to coal economy and deriving the most efficient results in ventilation itself, the electric fan offers an ideal solution. The modern warship being divided into numerous compartments, each of these can be supplied with its own electric fan or fans, either for isolated ventilation or to supply a system of only such extent as will involve no sacrifice in efficient ventilation. The type of engine now employed with steam ventilators undoubtedly requires anywhere from 75 to 200 pounds, and even more, water per horse power-hour. In the case of a large electric plant and with fan motors of the most ordinary efficiency, this would be reduced to considerably below 50 pounds, while at the same time the ventilation for a given expenditure of power would be greatly increased in efficiency.

Whether electricity should also be applied to furnace blowers for forced draught is an open question at the present moment, in view of the very infrequent use of such blowers and consequent large idle electric plant normally that would be entailed.

Other employments of electric power, so obvious that their adoption can not be greatly delayed, are in driving the work-shop and ice machine now installed aboard every warship. The engines of the latter are particularly inefficient, aside from their immense inconvenience through the heat given forth. In these cases the application of the electric motor is so simple that it can not be open to question, and the same remark applies to winches and ash hoists. On the ship of which I was chief engineer there were six of these, which, I estimated, consumed steam at the rate of over 150 pounds per horse-power hour, not counting the great condensation in the long lengths of steam supply pipes.

Steam pumps are, as is well known, grossly inefficient in steam consumption, and the same is true to a lesser extent of other auxiliary machinery connected with the propelling engines. While it may be claimed that it would be inadvisable to render the operation of the propelling machinery, particularly in time of battle or during storms, dependent on obtaining power from the electric mains, in reply it may be said that the number of different engines at present employed to run the auxiliary machinery is in itself a great hazard, for the breaking down of almost any one would alone affect the operation of the main propelling machinery.

Among other probable applications of electricity in the future are to anchor hoists and steering gear. The navy has had a somewhat unfortunate experience with the latter, and this, by the way, carries a lesson with it for those interested in introducing new electrical machinery aboard warships.

The lesson is that in every case possible such machinery should first be tried aboard merchantmen, and all experimental work entirely completed before attempting to secure adoption by the navy. In many cases it would possibly not be a difficult matter to find opportunities for making the trial on coastwise or freight steamers, or on harbor vessels, though sometimes, however, at the expense of those putting the apparatus aboard.

Steering gear and anchor hoists now furnish good subjects for the electrical designer, and if previously tested in the manner described, would undoubtedly stand an excellent chance of adoption for use in the navy in the near future.

As I have intimated, it must be reluctantly acknowledged that, notwithstanding the extremely efficient showing which electricity made during the late war, it is apparently at the present moment not in high favor at the Navy Department. The chief of the bureau having charge of electrical matters has recently reported very gloomily concerning the difficulty experienced aboard ship in keeping the generating plant in an efficient state; and the Naval Board of Construction has recently refused to further extend the application of electricity on ship board, the decision being that the use of electricity has gone far enough for the present.

It is quite probable that this unfortunate decision was arrived at owing to the unfavorable condition referred to concerning efficient operation. Why the operation of an electric plant of the size installed aboard ship should present any considerable difficulty will probably be a puzzle to those here present who are conversant with electrical operation ashore, as it would be also to those familiar with merchant ship electric lighting. The clue is given, however, in a remark by the bureau chief, as to the difficulty met with in obtaining an efficient operating force, the fault thus lying, it is to be surmised, not with the electrical apparatus, but with the electrical personnel.

In view of the manner in which professional pride and the electrical industry are thus affected, it would appear entirely appropriate for the electrical fraternity to use its influence to have the appropriate remedy applied to the serious defect which has thus been officially acknowledged to exist. What this remedy should be might well prove the subject of a departmental, or even of a Congressional, investigation. That it is due to a faulty system, and not chargeable to lack of zeal on the part of the officers affected, can, I believe, be taken for granted.

Electric Plants in Lourenco Marquez and Natal.

In his annual report, United States Consul Hollis, of Lourenço Marquez, speaking of the prospects for improvement in trade in the colony, says that there is a disposition on the part of financiers of the Transvaal to invest money there. Already $250,000 has been spent by the Compagnie Générale d'Electricite, which has just completed an electric light station—the best equipped, Mr. Hollis says, that he has seen in South Africa. He continues:

The buildings have all been built of hollow French brick, with iron beams and girders. Three large engines and six dynamos have been installed. All the boilers, machinery and fittings have been supplied by the Fives-Lilles Company, of Rhone, France. Upon the iron posts that have been planted along the streets I have, however, seen the marks of an English firm. This company has a concession for 50 years to supply electricity for light and power, and also for the sale of electric lamps and fittings. The company has already contracted with the municipal chamber to maintain 600 sixteen-candle-power incandescent street lamps at an annual charge of £1,700 ($8,273.05) per annum.

The government here some time ago gave a Belgian syndicate a concession of 50 years to build and operate an electric street railway. On October 5 the Belgian consul here, who represents the holders of the concession, submitted the plans for the said railway to the Municipal Chamber, where they were approved and passed the same day. By the terms of the concession, work on the line must be begun within nine months from October 5, 1898, and in nine months more the line must be completed and open for traffic. The plans provide for about four miles of the overhead wire street railway system. In about a month an engineer will arrive from Belgium to make the preliminary surveys.

Although Durban, Natal, is out of my consular jurisdiction, I do not think that it will be out of place for me to mention here that the Durban Town Council is about to appoint a commission of two engineers to investigate and report upon the electric street railway systems of America and Europe, in order that they may intelligently decide upon the best system to be installed in Durban.

The Southern New England Telephone Company, of New Haven, Ct., has mortgaged its property to the New Haven Trust Company for $1,000,000.

Water-Power in Scotland.

[*From the Edinburgh Scotsman.*]

The next session of Parliament will comprise at least one bill of an unusual character, which, if it becomes law, can not fail to have an important bearing not only upon certain industries which are now languishing and being gradually driven out of the country by foreign competition, but also upon a district of Scotland so situated as to be little more than a great waste. The scheme is promoted by the Highland Water-Power Syndicate, a corporation which is understood to have very strong financial backing and to be supported by men who have an intimate knowledge of this class of work.

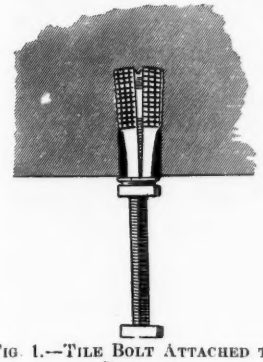


FIG. 1.—TILE BOLT ATTACHED TO CEILING.

The object of the syndicate is to utilize the waters of Loch Ericht, the east end of which is close to Dalwhinnie station, on the Highland Railway, the west end being 15½ miles away, and to convey them, along with the waters of other lochs, to the head of Loch Leven, on the west coast, some 20 miles distant, where a fall of upwards of 1,100 feet will be obtained, which can be utilized for generating over 23,000 electrical horse-power. Loch Ericht covers about seven and one half square miles of area and contains a very large quantity of water. The line of the canal will pass through a gently undulating country, which presents very few engineering obstacles. It will pass through the celebrated Black Water country, discharging its water, after passing through a tunnel about a mile long, into Loch Eilde Mòr, where two lakes are to be formed into one by means of a dam at the lower end of the valley, making another reservoir three and one-half miles long and a quarter of a mile wide. From the outlet of this reservoir another tunnel will be formed to convey the water to the end of the pipe line, which will carry it over a head of 1,100 feet in two falls, or, in other words, there will be two sets of power-houses, 550 feet apart vertically. The total length of this pipe line will be about 1,200 yards. The lower of the two power-houses will be situated within half a mile of the tidal waters of Loch Leven, navigable at high tide by vessels drawing 14 feet. At the head of the loch, some seven and one-half miles from Ballachulish, there is good anchorage for vessels. Another source of supply for water will be the valley of the Black Water, along which, at a higher level, the upper canal from Loch Ericht will run. Here a dam 60 feet in height will be constructed at the lower end of the upper fall, and this will throw the water back, forming a reservoir seven and one-half

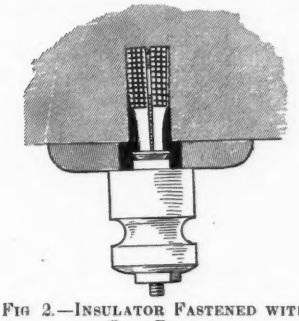


FIG. 2.—INSULATOR FASTENED WITH TILE BOLT.

miles long and from one-fourth to one-half a mile wide. The aqueduct will be formed mostly in tunnel for about three and one-half miles to the head of the pipe line at a point where a fall of about 950 feet can be obtained close to the Loch Ericht pipe line. This head of water will also be broken into two falls, which will join the Loch Ericht water in the storehouses common to both. It will give an additional 14,000 horse-power, so that the total horse-power expected to be obtained from Loch Ericht, the Black Water and Loch Eilde Mòr—which is part of the Loch Ericht system—will be between 37,000 and 38,000 horse power.

One of the chief features of the proposed scheme is that the power can be brought to the sea at a comparatively cheap rate, so that whatever industries may be attracted to the spot will have a cheap means of transit for the raw material and the finished products such as could not be obtained if they were dependent upon railway carriage. The industries likely to be attracted by cheap electrical power are those of the chemical and allied trades. These, at all events, are the industries on the Continent and in America which have been most eager to avail themselves of the advantages which cheap electrical power affords. At the present time some sections of the chemical trade in this country are being ruined by foreign competition, and some British manufacturers have in contemplation the change of their works to countries where cheap electrical power, coupled with easy transport facilities, can be obtained. The possession of 37,000 or 38,000 electrical horse-power at Loch Leven will avert the extinction of an industry which can not hold its own against the electrolytic process now being so largely adopted in Germany and America, as a result of cheap and abundant water-power.

The engineers for the work, which, it is estimated, will cost over £1,000,000, are Mr. George Anderson, Edinburgh; Mr. Reginald Middleton, London, and Messrs. Kincaid, Waller & Manville, London.

A Tile Bolt and Lock.

The accompanying illustrations show a tile bolt and lock devised for use in fireproof buildings where the columns and girders are covered with

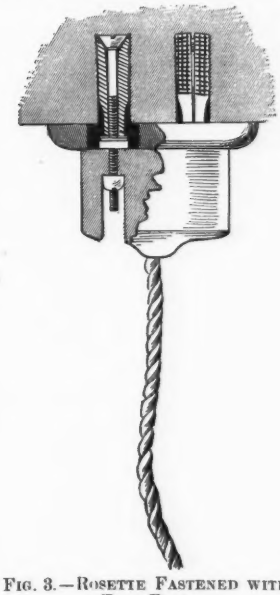


FIG. 3.—ROSETTE FASTENED WITH TILE BOLT.

tiling. It is a safe and simple method for fastening insulators, rosettes or other electrical appliances to ceilings, columns or walls. It can not be pulled out when properly set, and yet can be easily removed when desired. It is manufactured by the Western Electric Company, of New York and Chicago.

This device consists of two pieces of metal with partially corrugated outside surfaces which, when placed together, form a shape similar to a cone. The opening in the upper end, when the pieces of metal are put together, is countersunk, allowing the bolthead, to which the insulators or other devices are to be fastened, to fit snugly between the two pieces of metal. These two pieces of metal, together with the bolt, are inserted in a hole in the tiling. A small concave washer slips over the bolt and a nut is then screwed up close to the ends of the small pieces of metal; as it is gradually tightened it draws the bolthead down into the space between the two pieces of metal until it makes them bind tightly to the sides of the hole, the end deepest in the hole binding tightest; this leaves the shank of the bolt free for attaching any device that may be desired.

Fig. 1 shows the screw or bolt attached to a ceiling, while Figs. 2 and 3 show, respectively, an insulator and a ceiling button or rosette attached to the bolt. Fig. 4 shows how the tile bolt and lock may be used for attaching ornamental brackets to the side of a wall.

These tile bolts and locks are made in two sizes: One has a bolt three and one-half by one-fourth inch, including the two conical pieces of metal which are called the lock, one small iron washer, two small iron nuts and the bolt; the other has a bolt two by one-eighth inch, including the lock, the bolt, one small iron washer, one small iron nut, and one brass nut which is slotted so that a screw-driver as well as a wrench may be used on it. The latter is used principally for fastening rosettes to the ceiling, where two bolts are to be used on one device.

It will be particularly noted that partitions in the tiling or tile, or marble slabs resting against flat surfaces, do not interfere with the use of the tile bolt and lock as in the case of toggle bolts; with the tile bolt and

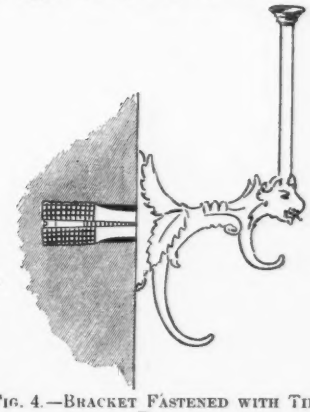


FIG. 4.—BRACKET FASTENED WITH TILE BOLT.

lock there is no need of an open space, as is required in the use of toggle bolts.

The new plant of the Palmyra, N. Y., Electric Light Company has been completed. A tubular boiler and two Corliss engines have been added.

ADVANCE INFORMATION

Increase of Capital.

WILLIAMSPORT, IND.—The Electric Haulage and Manufacturing Company has been incorporated, with a capital stock of $10,000.

FRANKFORT, KY. — Flemingsburg and Myers Station Telephone Company has been incorporated; authorized capital, $600; incorporators, I. B. Sherwood, W. R. Darnell, Robert Harper, I. N. Price, W. J. West.

SHELTON, CT.—The Russell-Tomlinson Electric Company has been incorporated, to manufacture, buy, sell and deal in electrical goods and wares; authorized capital, $20,000; incorporators, G. G. Milne, C. B. Barker, New York city; W. W. Tomlinson, Shelton; W. E. Russell, Danbury.

New Electric Railways.

HARTFORD, CT.—F. W. Siebert, Edward W. Shedd and C. Siebert will apply to the incoming legislature for a charter to build an electric railroad in Cromwell.

BARABOO, WIS —The City Council has granted a franchise to the Devil's Lake, Baraboo & Dells Electric Railway Company; incorporators, attorney Herman Frolophout, of this city; F. J. Butler, of Wonewoc, and E. F. Cutterel, of Milwaukee.

POTTSTOWN, PA. —The Montgomery & Chester Electric Railway Company has been incorporated by W. H. Grebe, C. S. Jarvis, G. G. Fitler and others, to construct and operate an electric railway from Pottstown to Phœnixville; capital stock, $300,000.

BLOOMFIELD, MICH.—The Bloomfield & Orchard Lake Electric Railroad has been incorporated by George L. Hendrie and others, with a capital stock of $50,000.

ALLENTOWN, PA.—A new electric railway has been chartered. It will connect this city with Slatington, a distance of 17 miles. The capital stock is $200,000. The directors are: Francis J. Crilly, president; John L. Schwartz, Patrick F. Cannon, Walter J. Saeger, Francis R. Kreibs. It is expected that the road will be in operation in a year.

SARATOGA, N. Y.—New York capitalists, who control the Saratoga Traction Company, which runs from Saratoga to Saratoga Lake, and to the Geysers, will, it is stated, continue the trolley system from the Geysers to Ballston Spa, a distance of five miles. This extension would be another link in the network of electric roads in this vicinity, in time running from Glens Falls to Albany.

Electric Light and Power.

HASTINGS, NEB.—Denver parties are in Hastings for the purpose of organizing a company to purchase the present electric light plant. It is proposed to make it one of the best plants in the West.

CANTON, N. H.—An electric light plant is to be established here.

SOMERVILLE, TENN.—T. B. Yancey, Mayor, may be addressed concerning construction of electric light plant.

MILLBROOK, N. Y.—Millbrook Gas and Electric Company has been incorporated with a capital stock of $15,000.

PIERRE, S. D.—The new city electric light plant is now in course of construction.

WEST CONCORD, MINN.—E. W. Vanorman will shortly establish an electric light plant.

PERRYVILLE, OHIO—This village is soon to be lighted with electricity. A plant is about to be put in and the generation of the current will be accomplished by means of water-power from the site of a flouring mill which was destroyed by fire two years ago.

SHERIDAN, IND.—The Sheridan Light and Power Company has been incorporated; capital, $9,500. Directors: Charles S. Knight, H. C. Knight, W. L. Polhamus.

EAST CHICAGO, IND.—The East Chicago Light and Power Company has been incorporated; capital, $15,000. Directors: George W. Wilson, H. N. Bailey, W. L. Pike.

SALEM, ILL.—Work on the electric light plant here is progressing rapidly, and the same will be completed by January 1. Preparations are being made for a fitting demonstration on the evening that the current of light shall be turned on for the first time.

MILLBROOK, N. Y.—Millbrook Gas and Electric Company, with its principal office at Washington, has been incorporated; capital, $15,000; incorporators, Wm. E. Smith, Millbrook; Richard J. Scoles, Samuel Thorn, New York city.

SEATTLE, WASH.—The Seattle power plant will be in operation by January 1. The power is to be furnished from Snoqualmie Falls.

NEW YORK, N.Y.—Delaware Electric Light and Power Company has been incorporated by P. G. Stappens, D. McM. Niven and C. W. Phillips; capital stock, $250,000.

New Incorporations.

AUGUSTA, ME.—The Arizona Water Company has been incorporated. The object of the company, whose capital stock is $1,500,000, is to buy and sell and operate canals, waterworks, electric light and power plants, etc. The property of the Arizona Improvement Company and the Arizona Canal Company will be handled by this new company. The stockholders of the new company are A. B. Leach, Chas. S. Fairchild, Hiram Steele, New York; E. Allen Frost, Chicago; Jno. R. Tillman, Edward S. Sanford, New York; Wm. J. Murphy, of Arizona, and several others who hold only one share each.

ST. LOUIS, MO.—The Western Railway Equipment Company, of Illinois, has been incorporated; capital, $300,000; capital to be used in Missouri, $50,000; with offices in this city.

JERSEY CITY, N. J.—Manhattan Microphone Company has been incorporated by John H. Mangham, Theodore J. Mitchell and Thomas A. Hutchins, for the purpose of making, buying, etc., microphones, telephones, etc.; capital stock, $100,000.

ST. PAUL, MINN.—The Printing-Telegraph and Typewriter Company has been incorporated, to acquire, own and lease printing-telegraph and typewriter instruments, etc.; authorized capital, $200,000; incorporators, Casper Ernst, St. Paul; Frederick Hachman, Milwaukee; Charles Pfeifer, Plymouth, Wis.

CHARLESTON, VA.—The Kitson Lighting and Heating Company, of Japan and China, principal office, Charleston, Va., has been incorporated, to buy, sell and manufacture apparatus or materials for the production of heat, light and power; authorized capital, $1,000,000; incorporators, A. D. MacCorkle, J. W. Malcom, J. E. Chilton, J. E. Scaggs, W. E. Chilton, Charleston.

JERSEY CITY, N. J.—The Dennison Motor Carriage Company, incorporated by Geo. L. Record, Ernest Merrick and J. F. Dennison, to manufacture engines and electrical and other motors; capital stock, $100,000.

New Telephone Companies.

SAN ANGELO, TEX.—The new telephone line projected to Sterling City is now completed and in operation to Water Valley, 22 miles to the northwest of here.

LOWVILLE, N. Y.—A telephone line connecting Constableville, Mohawk Hill and West Leyden with Boonville, is being constructed by Domser Brothers, Jay Gantner and Fred C. Meyers.

HARPERSVILLE, N. Y.—The telephone line from this village to North Colesville is now complete. The one to Sanitaria Springs, by way of Martin's Hill, is under construction. A third line will connect Doraville, and still a fourth line will reach down Welton street as far as D. A. Watrous.

TUCKAHOE, N.J.—A new telephone line has been established between Belleplain, Eldora and this place.

WEST COVINGTON, KY.—A new telephone company has been organized, and will be put in operation between this place, Ludlow and Bromley in a short time.

TIFFIN, OHIO—Telephone connection between this city and Berwick, New Riegel and McCutchenville will be established in a few days.

LIVONIA, N. Y.—The Bell Telephone Company is to extend its line from this place to Springwater.

PHILADELPHIA, PA.—The Standard Telephone, operating in the vicinity of Newtown and Langhorne, will have a line to Doylestown and Bristol within a few weeks.

FLINT, MICH.—The State Telephone Company's line from this place to Davison has been completed, and will be extended to Ortonville, Goodrich, Atlas and Grand Blanco.

CLAY, KY.—The Cumberland Telephone and Telegraph Company is making arrangements to extend its line to this place.

SPECIAL ANNOUNCEMENT.

New Readers of the Electrical Review.

The ELECTRICAL REVIEW, in its career of some 17 years, has never before recorded a subscription increase equaling the concluding days of 1898. While this may be attributed to quite an extent to the prosperity of the country, we still have the modest thought that, perhaps, the merit of the ELECTRICAL REVIEW, as a wide-awake electrical journal, is being appreciated.

It is our abiding faith that the ELECTRICAL REVIEW has more subscribers who pay for it and read it than any similar journal in this country.

We have never been a noisy circulation claimant, as such things are generally very largely discounted in the minds of the public, but we do believe that a journal that will have been in existence by the end of January, 1899, for the good, round period of 17 years, and is now more widely read, more widely quoted, more influential, and possesses a larger list of subscribers and a larger list of advertising patrons than ever before, is entitled to a modest word of self-congratulation.

The new subscribers that the daily mail brings to this office are from all parts of the world. The order we publish herewith is so much to the point—not a word wasted—that we present it, and it is but one of a great many:

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One whose occupation or inclination leads him to take an interest in electrical matters will do well to add the ELECTRICAL REVIEW to his list of periodicals, if he is not already a reader of that publication.—*Globe-Democrat, St. Louis.*

LITERARY.

The new year of *Scribner's Magazine* opens in the January number with several features of great distinction. The place of honor is given to Governor Roosevelt, who will contribute not only his continued story of "The Rough Riders," but other articles on the naval preparations, the strategy and other important subjects growing out of the war with Spain. The frontispiece of the number is a drawing from life by Charles Dana Gibson of Colonel Roosevelt, and it is a most satisfactory interpretation of the salient qualities in the face of the new Governor of New York.

In *McClure's Magazine* for January, Simon Lake, inventor of the latest marvel in the way of submarine boats, will describe the construction of his boat, and how he makes long journeys in her at the bottom of the ocean, and while there steps out of her by an open door into the very sea, and examines wrecks and fishes up cables and so on. Mr. Ray Stannard Baker, in the same number, will give an account of his own experiences on a submarine voyage in the Lake boat; and both articles will be illustrated with drawings from life by Mr. W. D. Stevens, who also made the voyage in company with Mr. Baker.

A catalogue of field and motor rheostats, theater dimmers and apparatus of this character has just been issued by the Ironclad Resistance Company, Westfield, N. J. The data contained in this catalogue makes it desirable for all electrical engineers and supply houses.

The American School of Correspondence, Boston, Mass., an institution chartered by the commonwealth of Massachusetts, are offering inducements for those desiring to take up courses by correspondence in electrical, steam and mechanical engineering. They inform the ELECTRICAL REVIEW that information will be given on all subjects which might come under these topics to all those who inquire.

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Kindred.... ...Interests

Thomas & Betts, 141 Broadway, New York, are now selling agents for the "New York" flush switch, "Helios" arc lamps and the "Chase Knock-Out" outlet and junction boxes.

Mr. Laurence W. Frank has succeeded to the business of the Technic Electrical Works, 214 to 218 New street, Philadelphia. Mr. R. L. Binder will continue as the manager of the business. The capital, facilities and equipment of the firm have been largely increased, and they expect to do a larger volume of business than heretofore.

The Electric Appliance Company, Chicago, are calling particular attention to the Jenkins switch, which is the latest arrival in the field of snap switches. The Electric Appliance Company claim that they are in a position to sell these switches at a very much lower figure than has ever been offered before on a first-class article. They solicit an opportunity to quote prices to all users of snap switches.

The Boston & Maine Railroad Company are erecting at Portsmouth, N. H., a building for their electric power-station. The building is 118 feet wide and 64 feet long, divided into two rooms—one for the boilers and the other for the engines and electric generators. The side walls are of brick, the roof construction fireproof; the trusses are of steel, and they support steel beams for the purlins, on which is to be placed a concrete roof. The contract for the steel work was given to the Berlin Iron Bridge Company, of East Berlin, Ct.

Kirmayer & Oelling, manufacturers of X-ray apparatus, 17 Bromfield street, Boston, Mass., recently published a catalogue showing the A-W-L Roentgen-light tube. The principles on which this tube are constructed were stated in a series of notes by William Rollins in the ELECTRICAL REVIEW for 1897 and 1898. The data relative to the subject of the construction of X ray tubes and their treatment are interestingly discussed in this little pamphlet, and all students of X-ray investigation should send for a copy.

The Western Electrical Supply Company, the large supply house of St. Louis, Mo., are just getting from the press for general trade distribution a new bulletin with complete data, cuts, etc., relative to all alternating-current apparatus, which include generators, transformers and arc lamps. They wish to announce that they will be pleased to mail this upon application. The condition of the electrical business as reflected by the increasing volume of business transacted by the Western Electrical Supply Company is particularly worthy of note. The company are excellently situated in the business center of the great West, and are in a position to know the actual conditions of the electrical industry.

Considerable has been written lately about an old sign in possession of the Western Society of Engineers, at Chicago. The words "Harper's Ferry," painted in black, stand out as boldly as when they were first formed by the artist's brush, while the wood around the letters, which was painted with white paint, has worn away about one sixteenth of an inch. It is asserted by the writers that no paint manufactured nowadays is equal in durability to that which was applied on the old sign. Mr. Wm. Hooper, of Ticonderoga, N. Y., does not see anything specially remarkable in the preservation of the old sign, and claims that there is just as good a paint made nowadays as then. He adds: "I have seen signs that have been painted with black paint directly on the clapboard of the building. The lettering was good after the paint on the balance of the building had disappeared; and after this the whole building was painted over, lettering and all, and the lettering obliterated, yet within ten years afterwards the old black lettering appeared again quite freshly to view. I suppose the paint for the lettering was made of linseed oil and lamp-black. I believe, however, that finely-ground graphite mixed with pure linseed oil will last as long, or longer, than any other paint ever known of or used. I had a large iron casting which laid in my mill-yard for over 30 years. It was painted with only one coat. The old casting was broken up and sold for old iron last month, and I noticed that the paint on the pieces of casting, even after being broken up, looked quite fresh.

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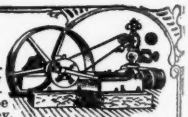
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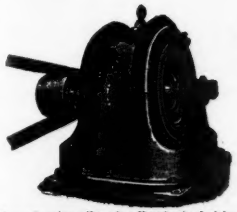

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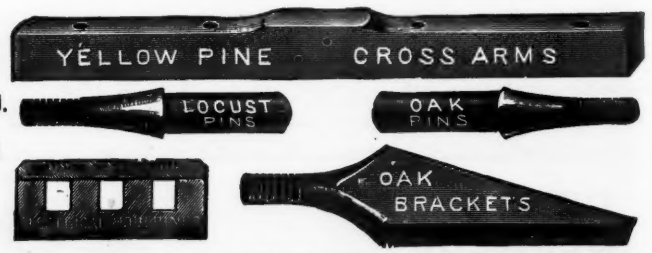

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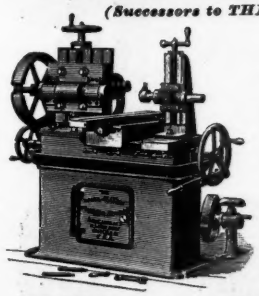

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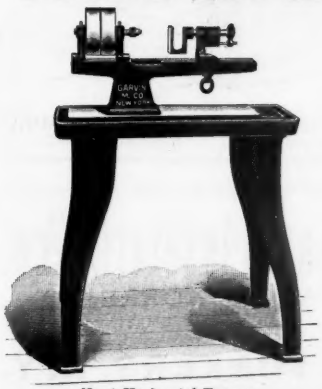

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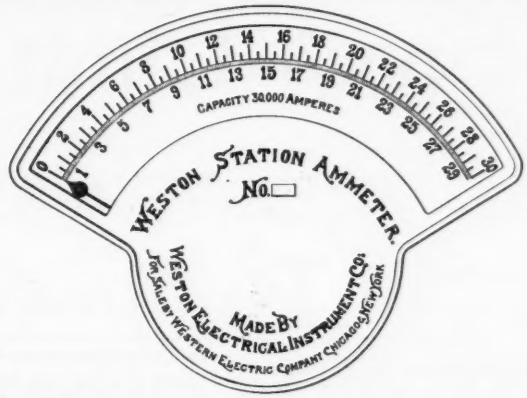

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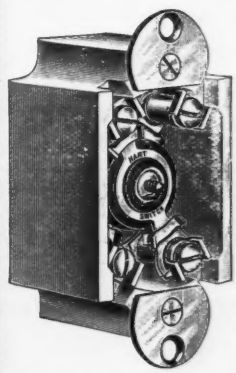

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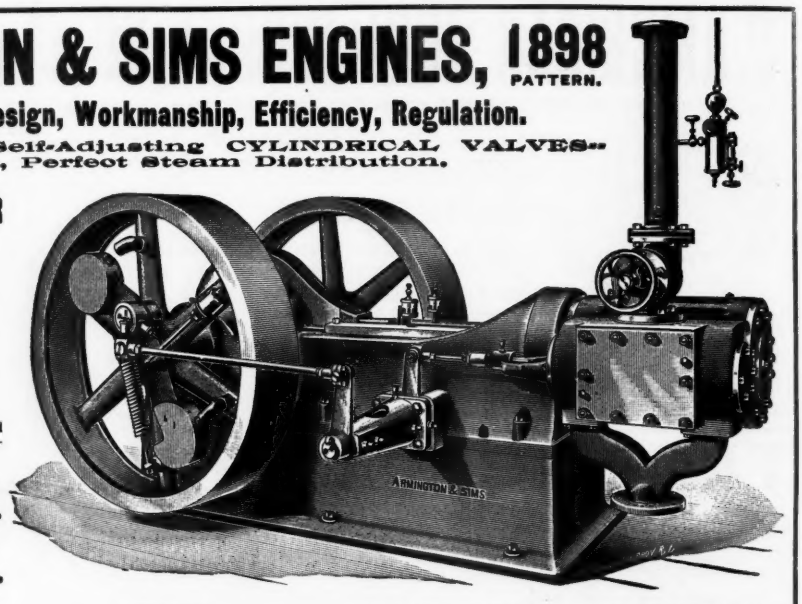

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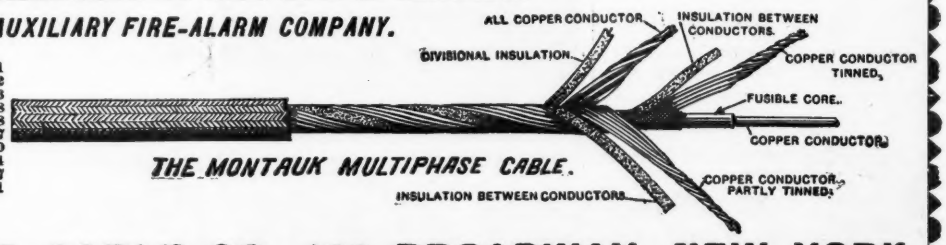

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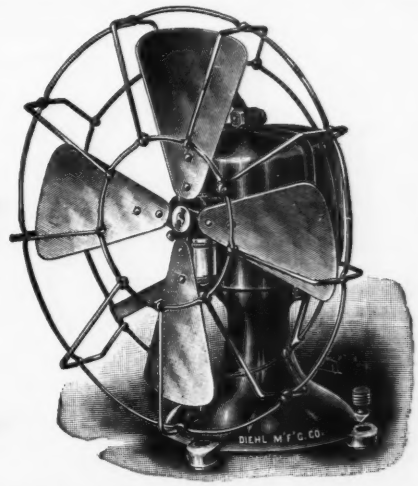

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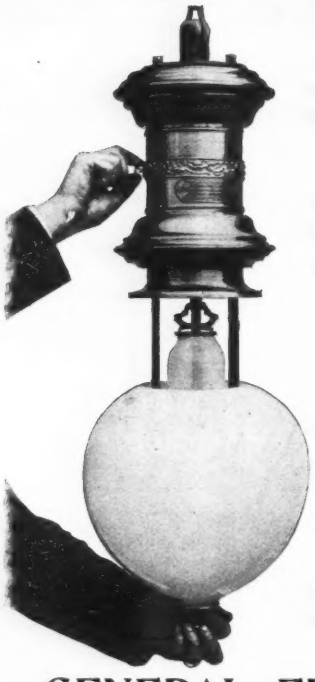

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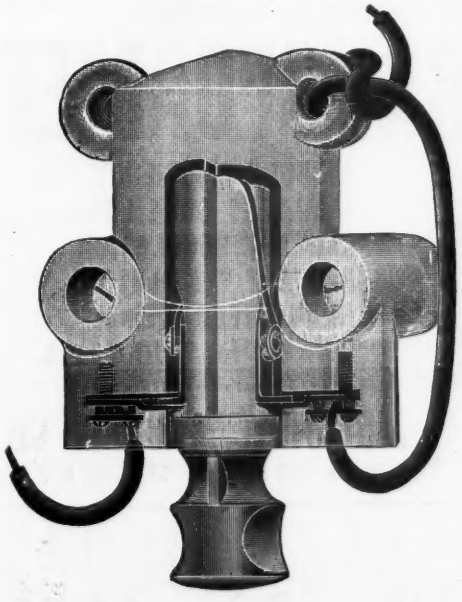

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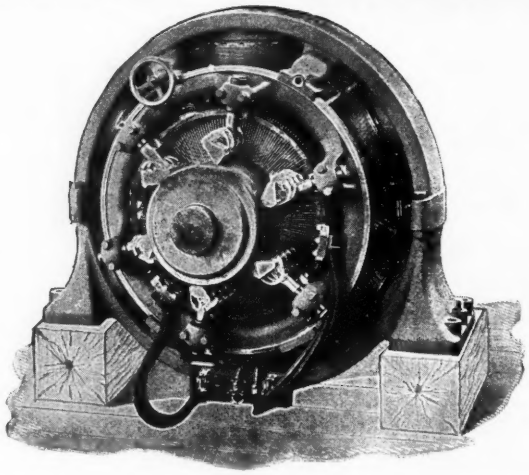

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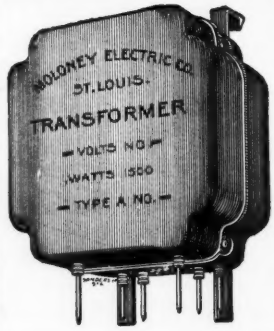

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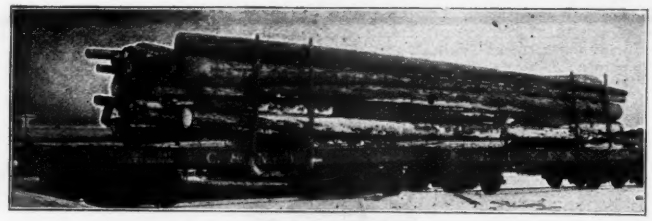

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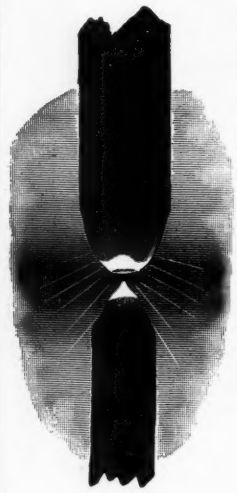

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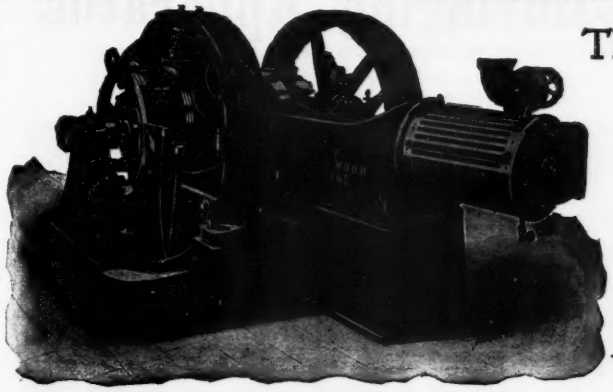

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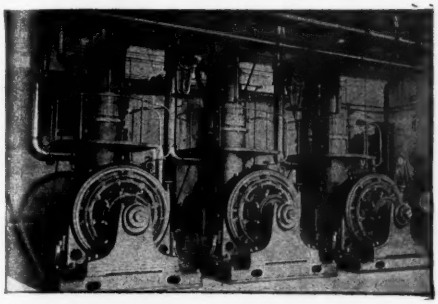

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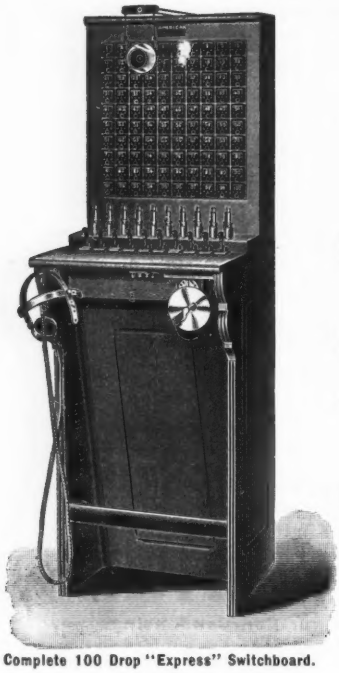

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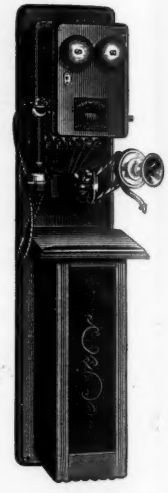

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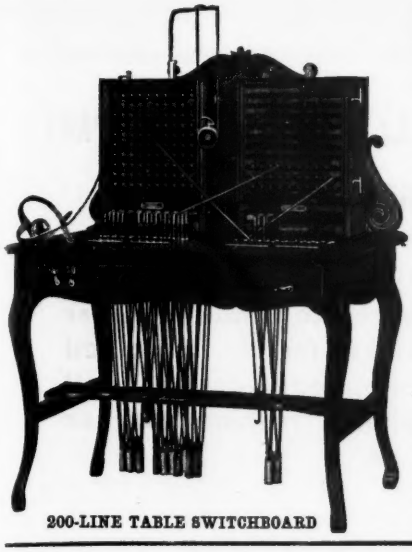

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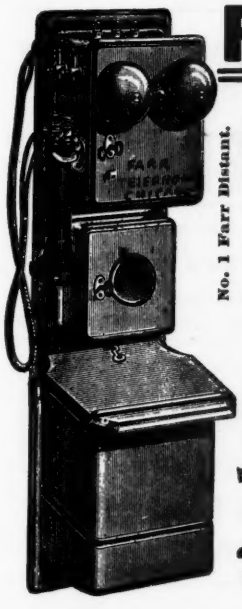

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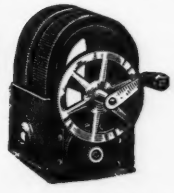

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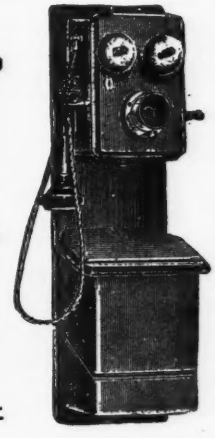

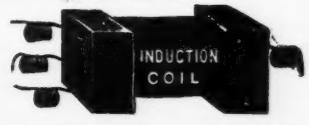

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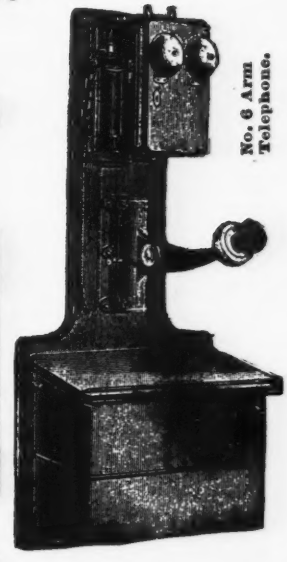

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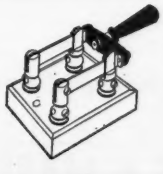

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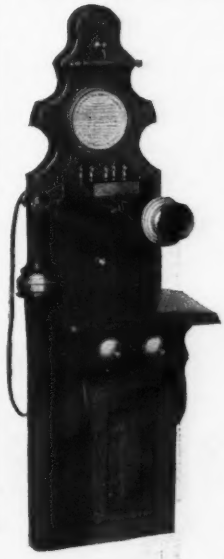

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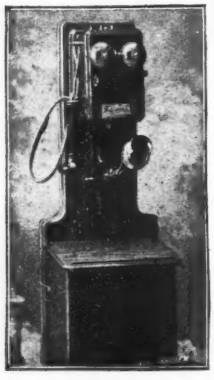

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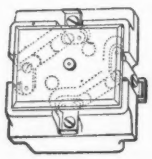

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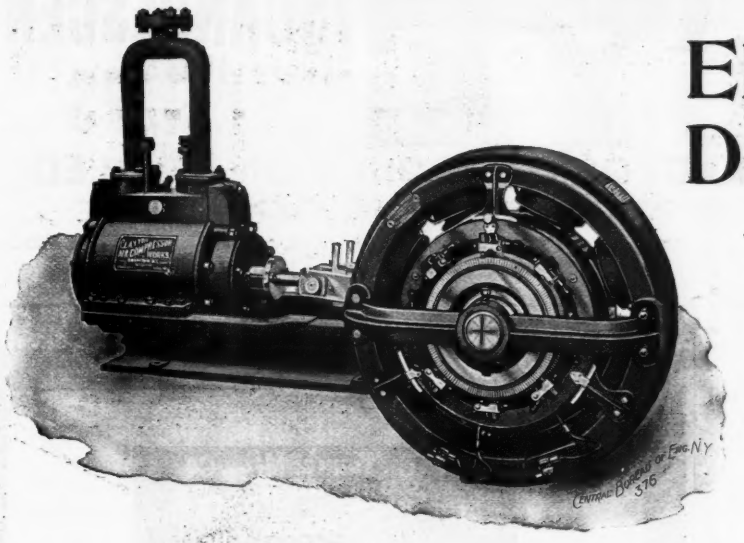

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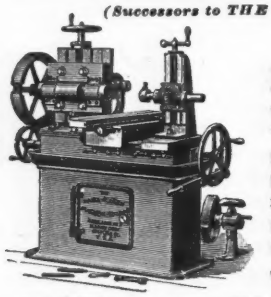

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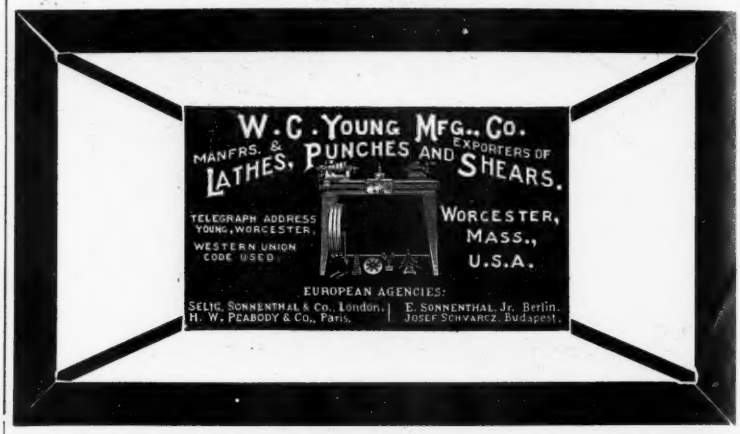
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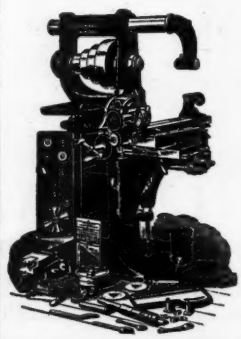

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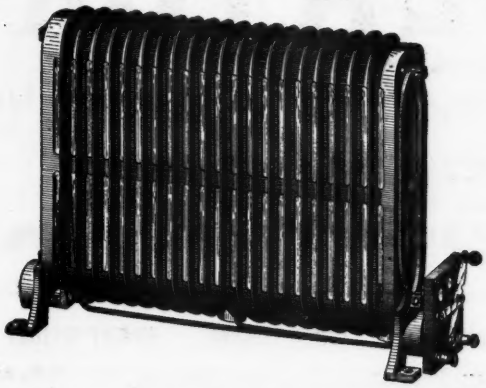

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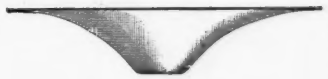

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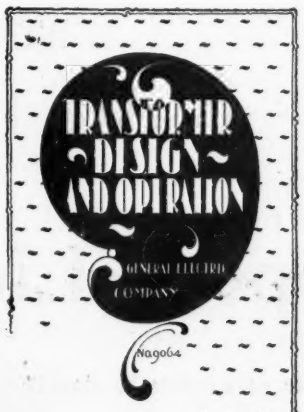

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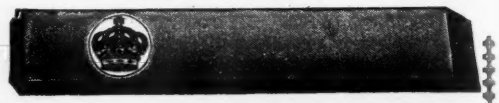

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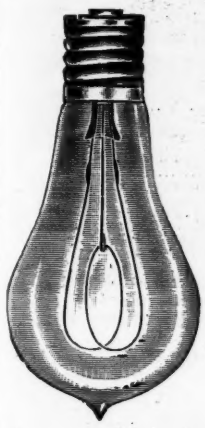

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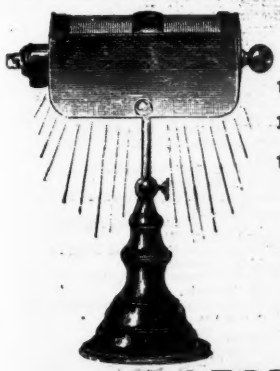

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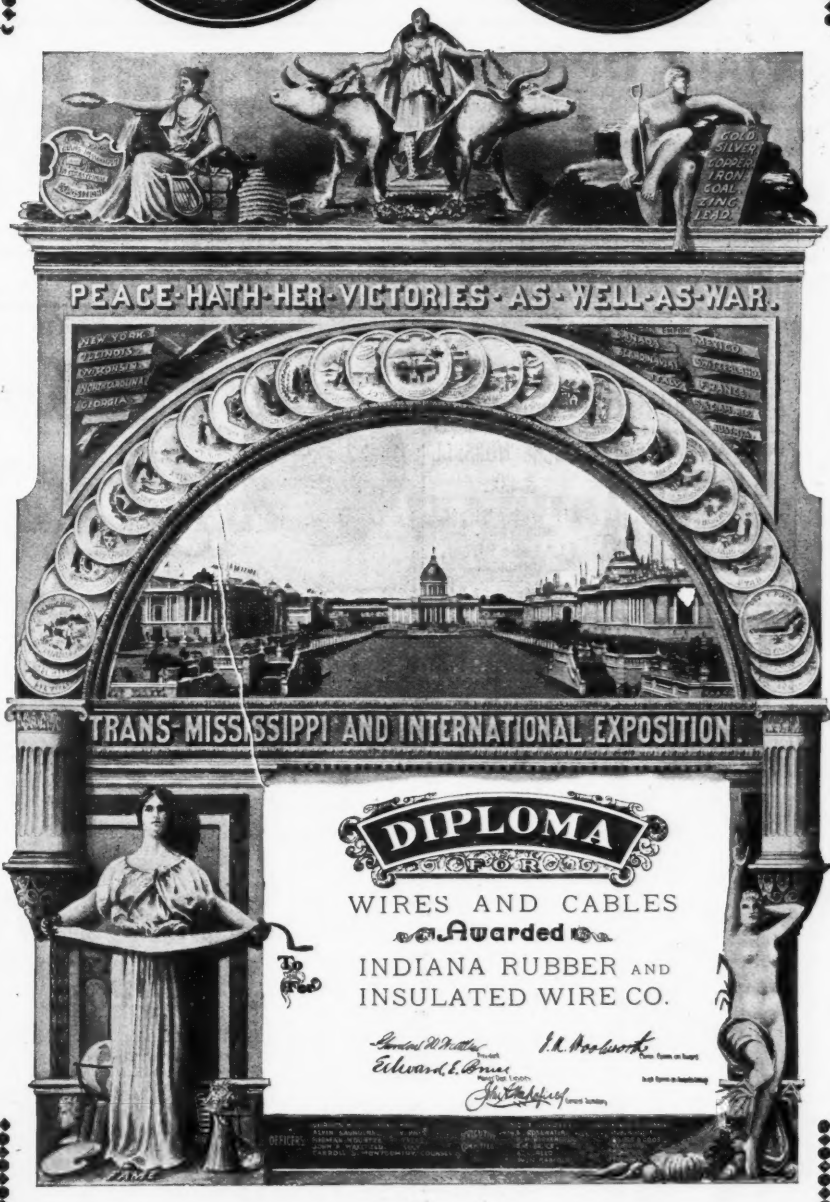

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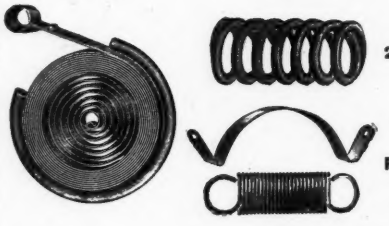

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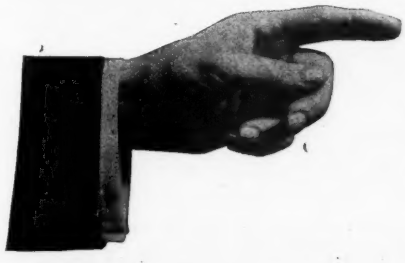

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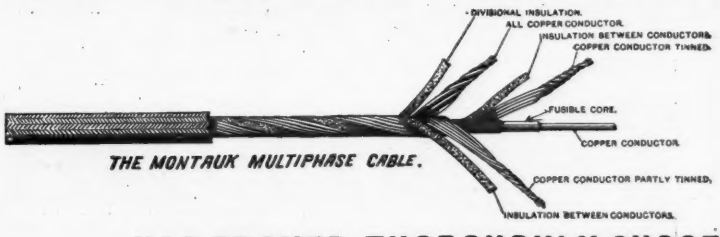

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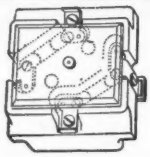

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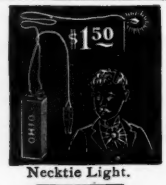

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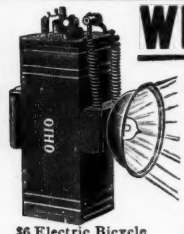

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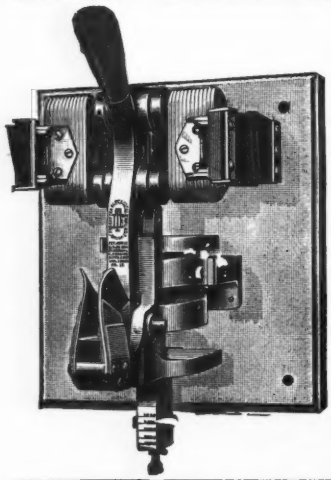

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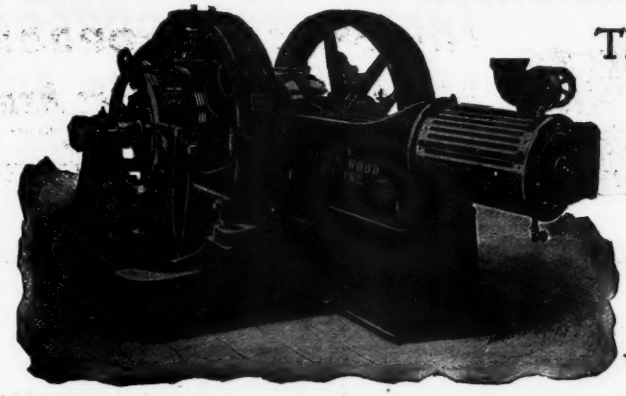

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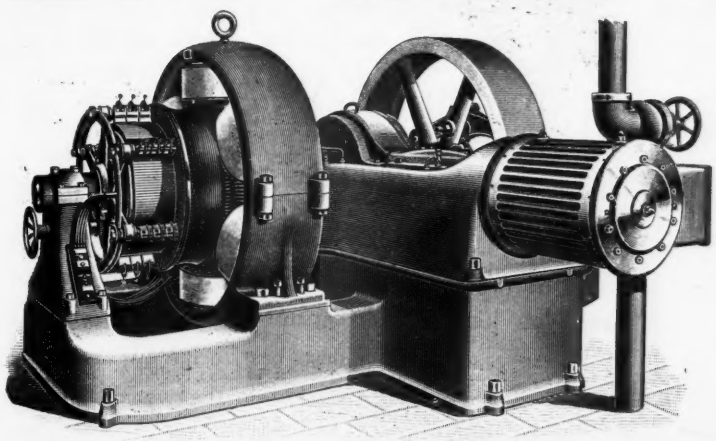

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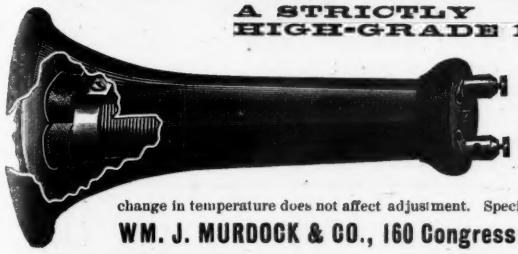

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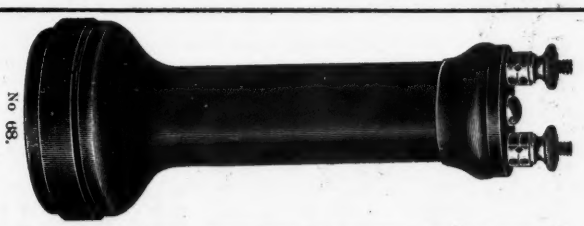

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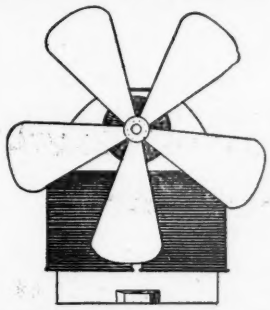

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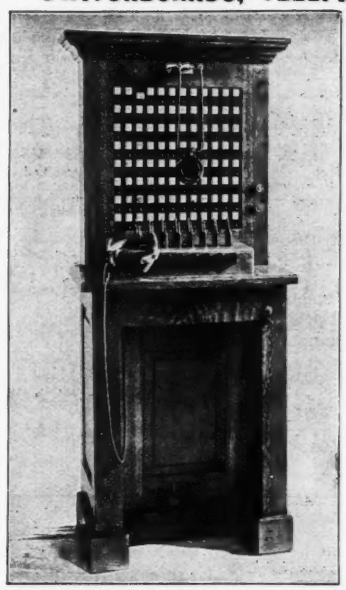

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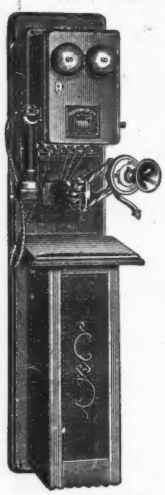

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